VOLUME XXIII NUMBER FIVE

THE NATIONAL GEOGRAPHIC MAGAZINE

MAY, 1912

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18 x 23 Inches.

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WITH 14 ILLUSTRATIONS A. J. WELLS

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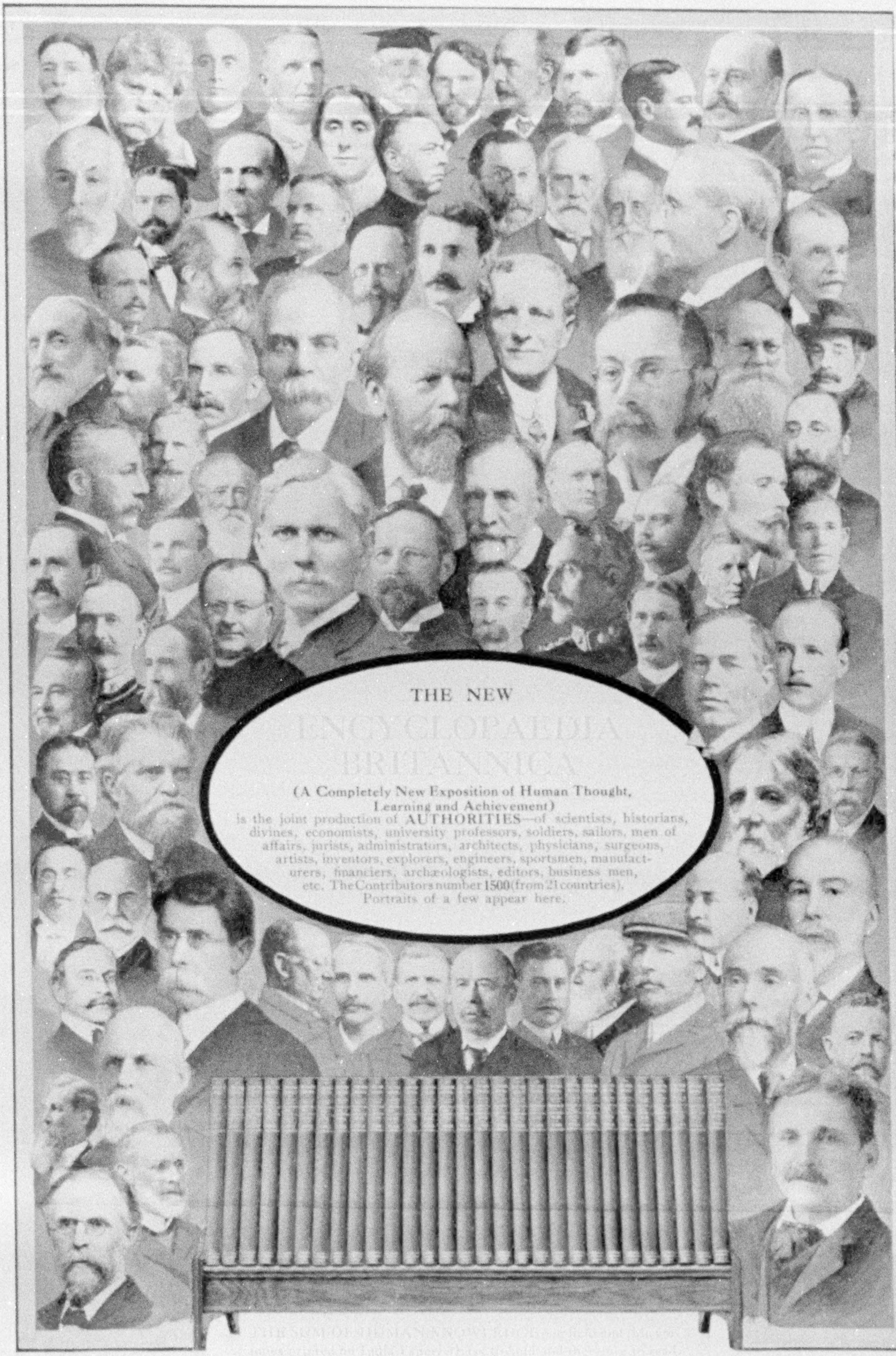

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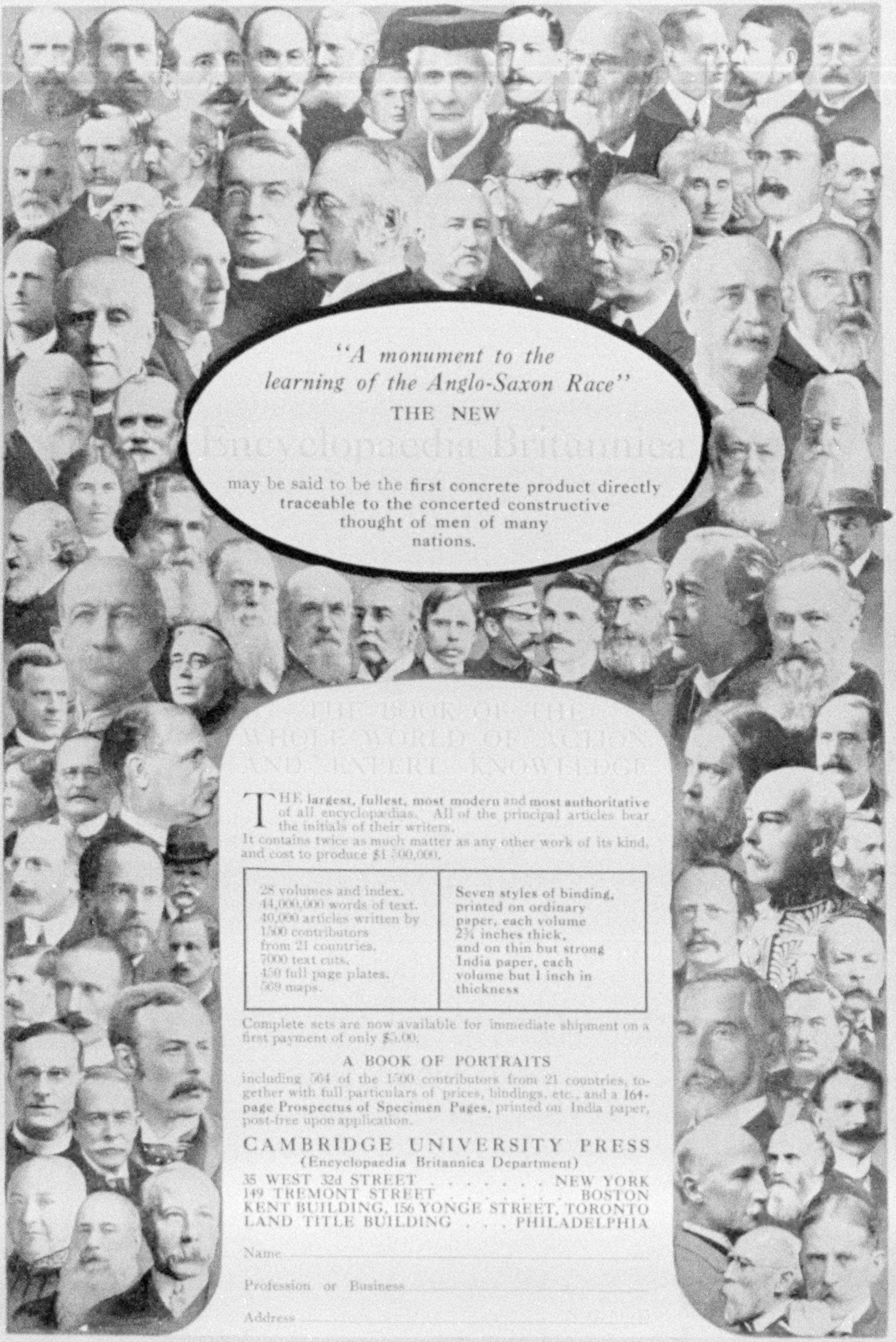

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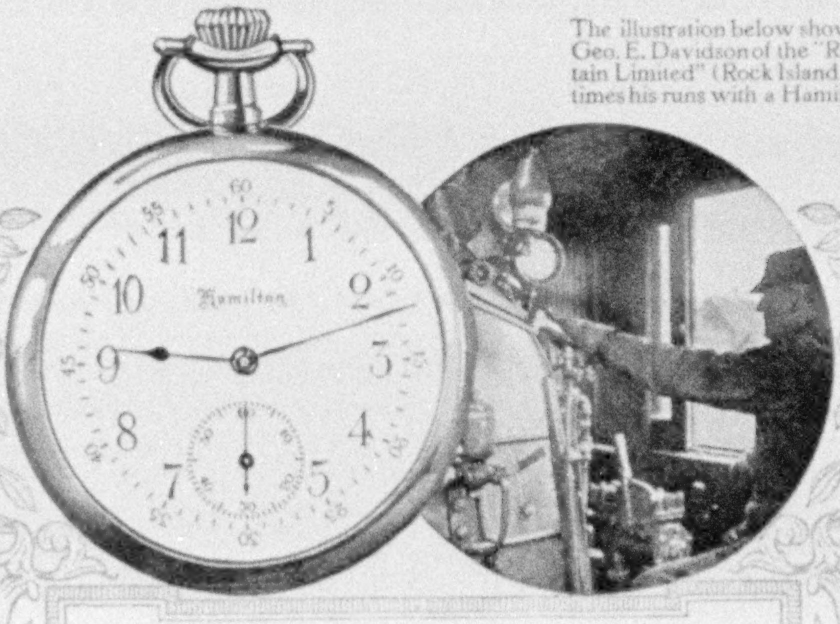

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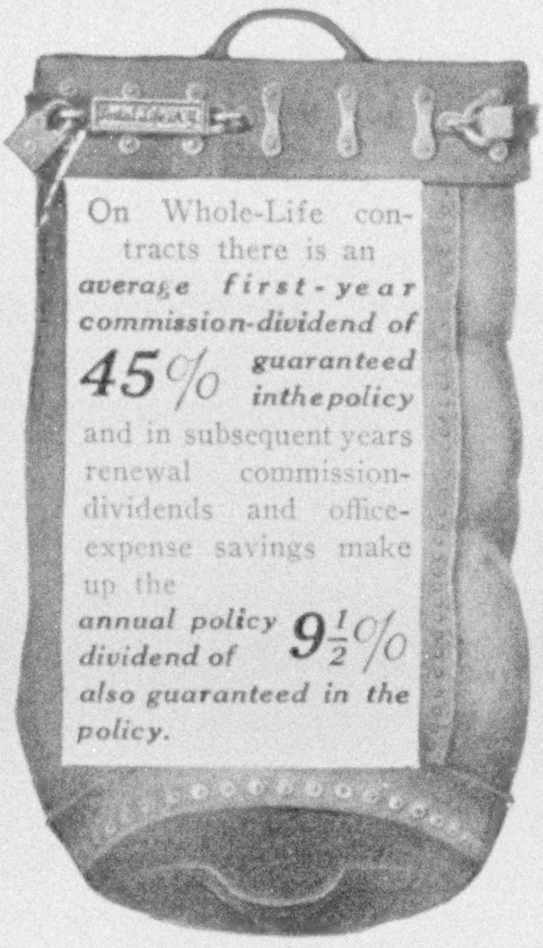

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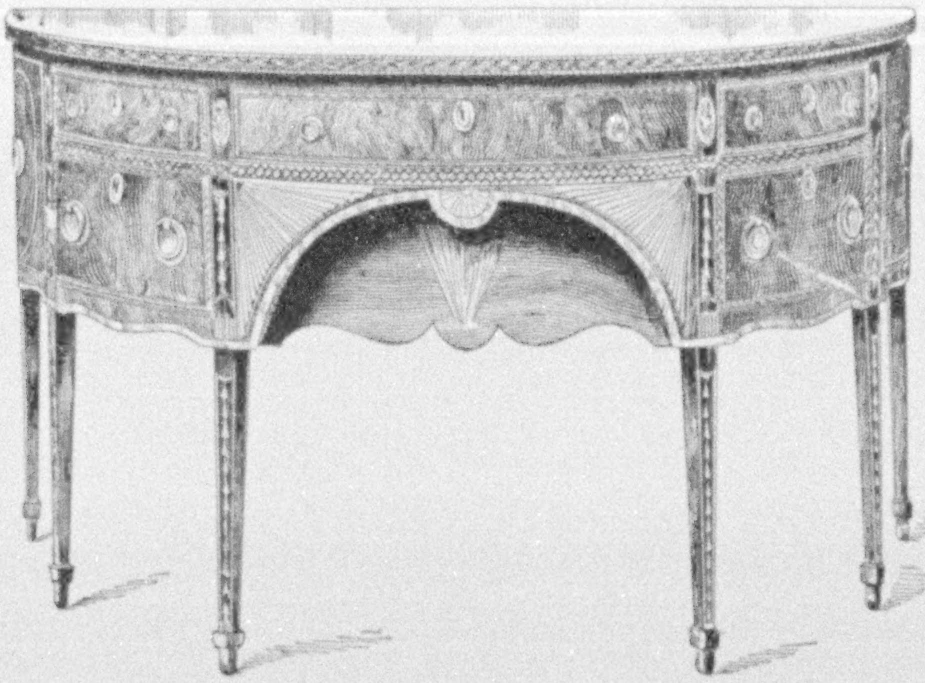

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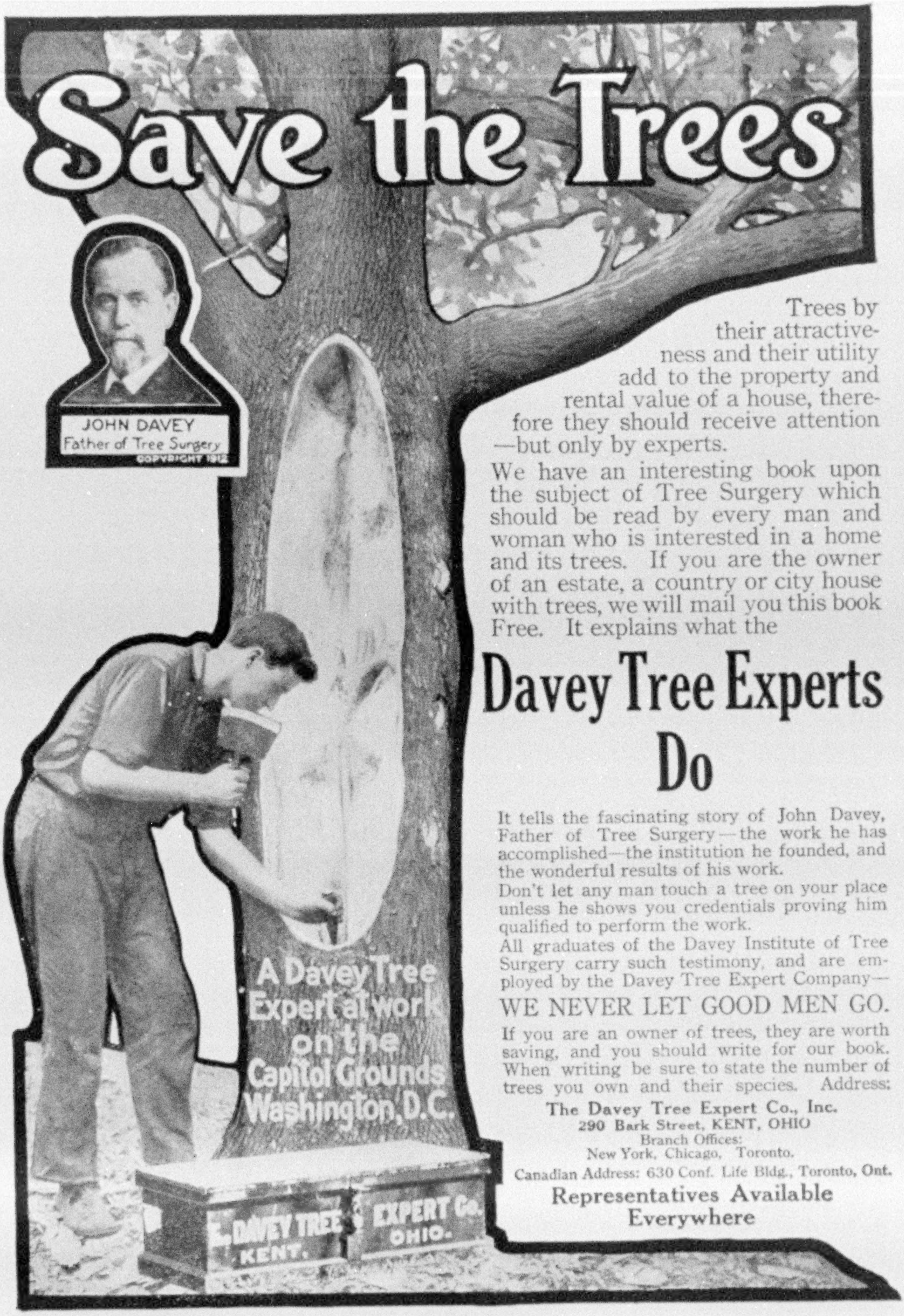

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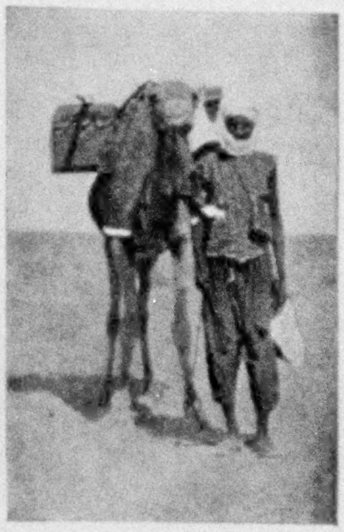

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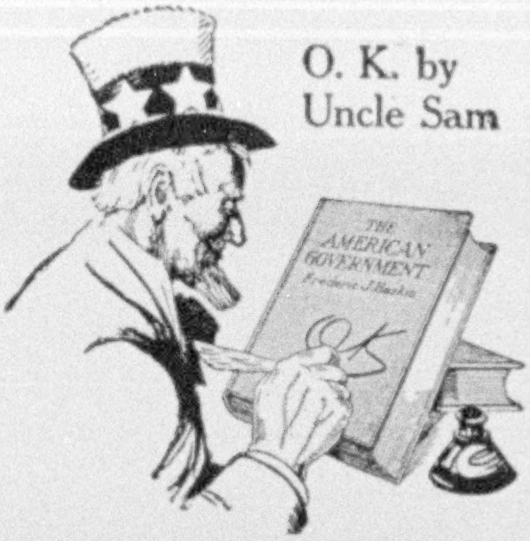

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Vol. XXIII, No. 5 WASHINGTON May, 1912

THE NATIONAL GEOGRAPHIC MAGAZINE

THE WHITE SHEEP, GIANT MOOSE, AND SMALLER GAME OF THE KENAI PENINSULA, ALASKA

By George Shiras, 3rd

Author of "Photographing Wild Game with Flashlight and Camera," "One Season's Game Bag with the Camera," and "A Flashlight Story of an Albino Porcupine," etc., in the National Geographic Magazine

FOR a number of years the writer had in view a trip to northwestern Alaska, to study the big-game animals and certain varieties of non-migratory birds, and where the camera, rather than the rifle, was to capture the permanent trophies of the hunt.

Experience had shown, long before, that it was not how far one traveled away from home, or how extensive and primitive the country, which necessarily meant success in the pursuit of wild life. Well illustrating this are the virgin forests and the burnt-over, second-growth country immediately north of Lake Huron or Lake Superior, now largely deserted by the fur traders, the Indian trappers, and numerous camp-followers.

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So with Alaska. The reports of miners, trappers, government explorers, and sportsmen, covering many years of persistent research, have shown very clearly that the mere distance traversed in this vast country often meant but little in regard to big game, since it was a matter of ordinary occurrence for persons to travel a thousand or more miles on the Yukon and some of its tributaries without seeing a single specimen of the larger animals.

One might also journey for a month with a pack-train into the interior, crossing the rough and sodden tundra, the willow-tangled swamps, climbing over the rock slides of disintegrating mountains, cutting out trails along the thicket-rimmed banks of the larger streams, or wading waist deep the swirling, ice-chilled waters flowing from the melting snowbanks and glaciers of the upper valleys, and during all these long days of unremitting toil and miles of steady progress only a few grouse or an occasional porcupine might fall to the rifle of the weary and ever-hungry traveler.

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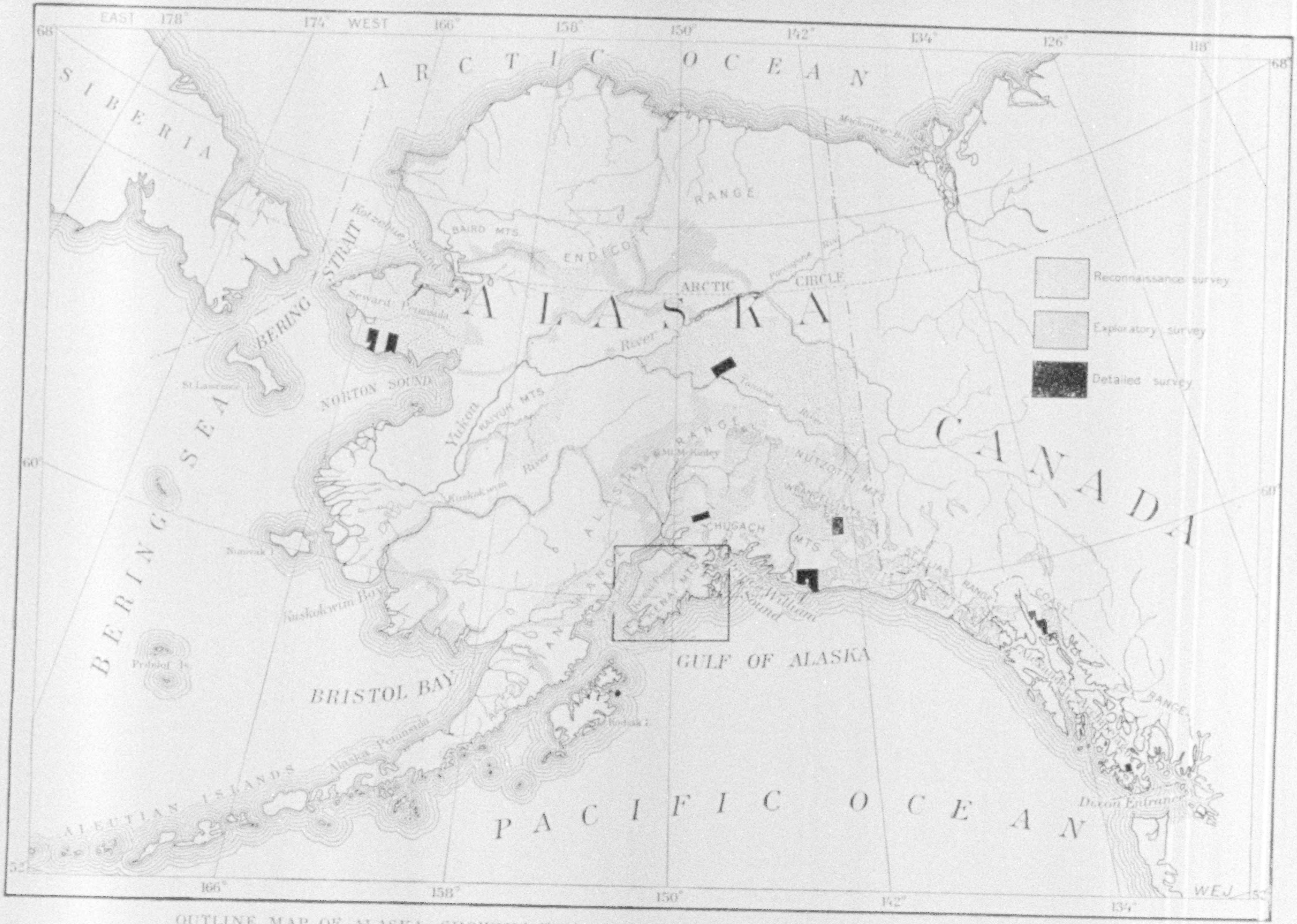
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Nunivak I.
Kuskokwim Bay
Pribilof Is.
BRISTOL BAY
Alaska Peninsula
ALEUTIAN ISLANDS
Kodiak I.
ALASKA RANGE
Mt. McKinley
CHUGACH MTS.
KENAI MTS.
Prince William Sound
WRANGELL MTS.
NUTZOTIN MTS.
Tanana River
Porcupine River
Mackenzie Bay
ST. ELIAS RANGE
COAST RANGE
GULF OF ALASKA
PACIFIC OCEAN
Dixon Entrance
CANADA
Reconnaissance survey
Exploratory survey
Detailed survey
EAST 178° 174° WEST 166° 158° 150° 142° 134° 126° 118°
68° 60° 52°

OUTLINE MAP OF ALASKA, SHOWING THE SECTIONS THAT HAVE BEEN MAPPED AND SURVEYED

Compiled from maps of the United States Geological Survey

This because the caribou is a wandering and uncertain animal to find in such a limitless country; because the moose frequently remain concealed for months during the summer in thickets of alder and willow at the edge of the timber line; because the bears, besides being largely nocturnal, hide most of the time in the densest jungles or feed high up the slopes on the tender grasses and wild berries until the coming of the salmon; because the sheep and the goats habitually occupy the higher ranges beyond the valleys of the larger streams.

Thus unless a side hunt is made back and up into the game country, one might often think that interior Alaska was a barren and tenantless waste, did not the old tracks in the clay bottoms and higher sandbars faithfully register the former visits of the hoofed and clawed animals of this mysterious and little-known wilderness.

AN IMMENSE COASTLINE

To one who has not followed a portion of the Alaskan coast, with its tens of thousands of islands, deep bays, extensive promontories, and countless channels, where the main shore for miles is walled in with precipitous glaciers or by the highest mountains, and who has not also penetrated sufficiently into the interior to understand the changes wrought by the difference in climate and topography, it is difficult to present a clear and adequate outline of this great area and its diversified conditions.

The general contour of the coast is known to many and its devious channels to a lesser number of experienced navigators. Where the interior is opened up by navigable streams or where the valleys and low divides allow the use of the pack-trains or the sleds and the adjacent mountains permit an unobstructed view, sometimes exceeding a hundred miles in circumference, it naturally follows that sufficient data has been obtained to dot and trace the small scale maps with an imposing array of mountains, lakes, glaciers, well-defined river-courses and tributary streams.

But, excluding the coast survey, less than 20 per cent of the interior is mapped, and detailed surveys represent a very minor portion of this (see map, p. 424). Until a permanently organized topographic corps is permitted to plan and pursue its work in a continuous and systematic way, instead of hurrying from one part of the country to another, as the mining camps or other interests seek assistance, the interior of Alaska can be known only in a fragmentary way from the early surveys of the War Department and the later records of the Geological Survey, which in recent years has done such splendid work in locating and appraising the mineral wealth and possibilities of the country and in suggesting the most feasible routes for its development.

One main difficulty in presenting a general geographic view of our last remaining continental Territory is not because it exceeds 600,000 square miles, or on account of its remoteness, but because Alaska is the most complex and irregularly shaped area of the size in the world. A good example is the Kenai Peninsula, which, with a total length of 150 miles, has a shore-line of more than 1,000—and a glance at the map, pages 428 and 429, will explain the reason.

Alaska lies on either side of the Arctic circle, is in both the Western and Eastern hemispheres, by reason of its westerly extension, and possesses a coast-line of 26,000 miles, exceeding the aggregate of the United States on the Atlantic, Gulf, and Pacific shores if we include in such survey the deeper indentations and the various groups of islands, one of which, the Alexander Archipelago, embraces more than 11,000 islands. The narrow chain of the Aleutian group extends, at right angles, more than 800 miles and within eyesight of Russian territory, where when the sun is setting in June it is rising on the Maine coast.

PHYSICAL AND CLIMATIC DIVISIONS

There are two comparatively distinct ocean areas on the Alaskan coast, separated by the Alaska Peninsula and its segmented extension, the Aleutian chain, which, largely intercepting the northerly flow of the Japanese current, also create marked climatic differences.

South of this barrier the warm current keeps the subarctic harbors open all the year; the humid air, coming in contact with the snow-covered coastal ranges and the glacier-filled valleys, produces a most extraordinary precipitation in rain or snow according to the season.

To the north, Bering Sea remains clogged with floating ice well into summer, and when the open water finally permits navigation to the Yukon delta and beyond, the warm moist air of the Japanese current, passing freely over the Aleutian chain, comes in contact with the cooler waters beyond and creates a dense and almost perpetual summer fog. Sometimes it may take several days to find and effect a landing on the Pribilof, or fur-seal islands, and then, like as not, the islands are finally located by the cry of the seal pups or the pungent odors from the breeding rookeries.

In a similar way the land area of Alaska has two distinct divisions. To the south and the east of the Alaska Range the country is rugged and mountainous, with valleys great and small and rivers swift and numerous, as necessary incidents, while to the north and northeast it is low and rolling, the streams more sluggish and separating into many channels on approaching the Pacific and Arctic coasts. Climatically the interior cannot be divided so readily. At the same altitude and period it is warmer in summer than on the coast and much colder in winter, the local variations occurring in the mountainous country, as might be expected, where the elevations range from 2,000 to 20,000 feet.

Of the two big-game animals particularly sought on this trip, one, the moose, was to furnish, if successful, a valedictory chapter of its many years' observation, and in the most westerly and northerly of the five districts into which the writer had endeavored to divide the continental range of this animal,* and the other was the beautiful white sheep of the subarctic mountains, a variety with which I had no personal acquaintance, but now desired to cultivate in an entirely friendly way.

To stalk, study, and photograph for the last time the largest, most unique, and impressive of our antlered animals, and then when this was accomplished to seek out on the rough mountain tops the snowy descendants, or perhaps in reality the progenitors of the Big Horn sheep of the Rockies, constituted a program sufficient in itself, though plenty of sensitive plates were in reserve for any other animals or birds worthy of portraiture.

To obtain satisfactory results from a first and rather brief exploration into a new and unsettled country, I think as much depends upon the comparative accessibility of the game field as upon the comparative abundance of the game itself.

The Kenai Peninsula, lying between Cook Inlet on the west and Prince William's Sound on the east, distant 1,500 miles from Seattle, was selected as not only the most accessible in territory and in the abundance of its game, but because in this favored region the moose and mountain sheep reached their highest perfection in physical development and, what was of equal importance, were to be found with certainty in well-defined ranges in this semi-island home.

THE KENAI PENINSULA—A MINIATURE ALASKA

It is seldom that a small, semi-detached portion of a large and diversified country can satisfactorily portray the whole, not only in the romantic history of its discovery and early explorations, but in those present-day conditions, where the climate, topography, and economic resources excite attention and comparison. Were all of Alaska erased from the map except the Kenai Peninsula and its immediately adjacent waters, there would yet remain in duplicate that which constitutes the more unique and that which typifies the whole of this wonderful country.

This is true of its tribal races and mixed descendants, of the hardy pioneers in well-governed settlements, where with the best of harbors, a railroad leading to the interior, steamships and cable lines to the outer world, they enjoy nearly all the advantages of modern civilization.

It is true, too, of the forests, herbage, wild fruits and flowers, the game and commercial fish, the native and migra-

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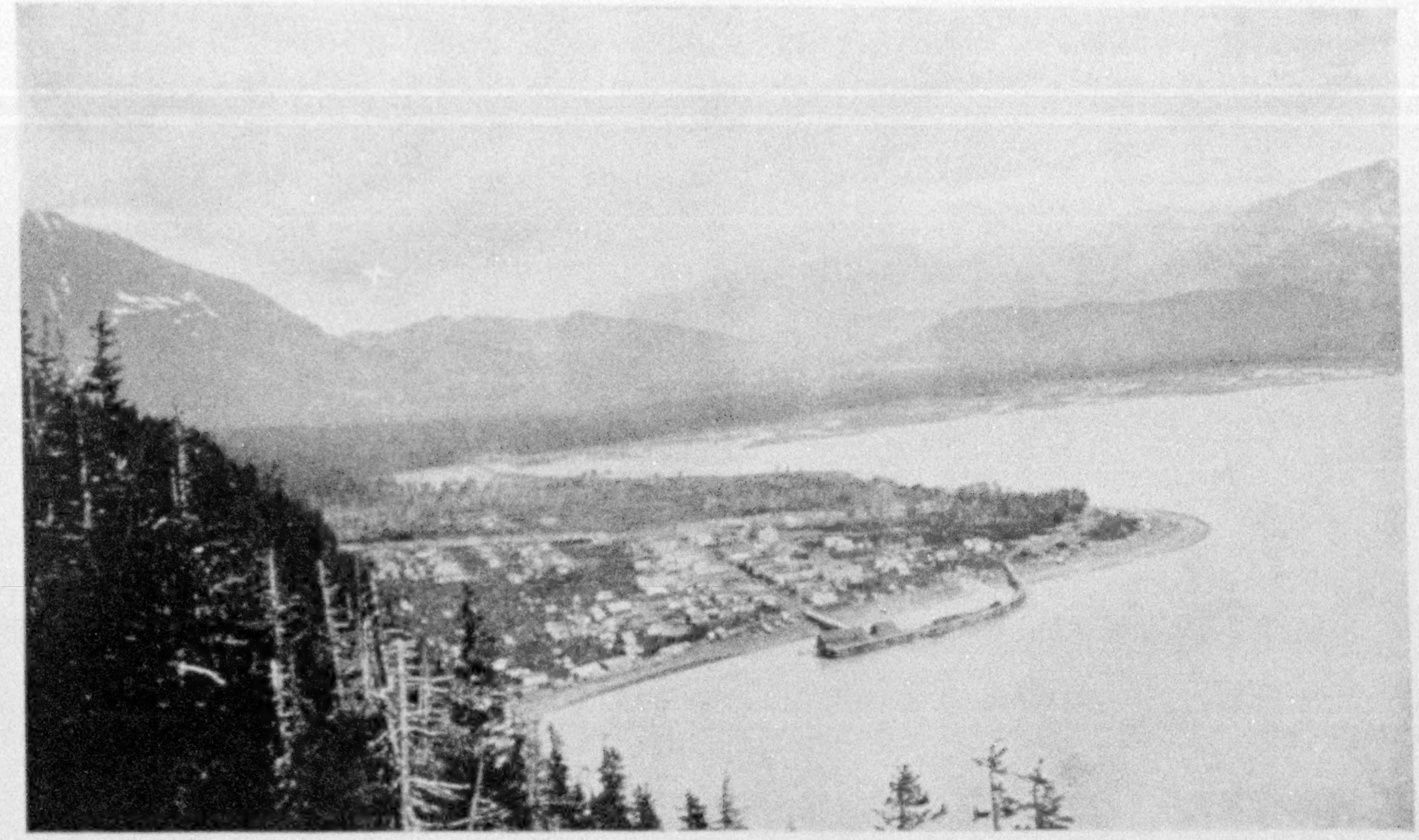
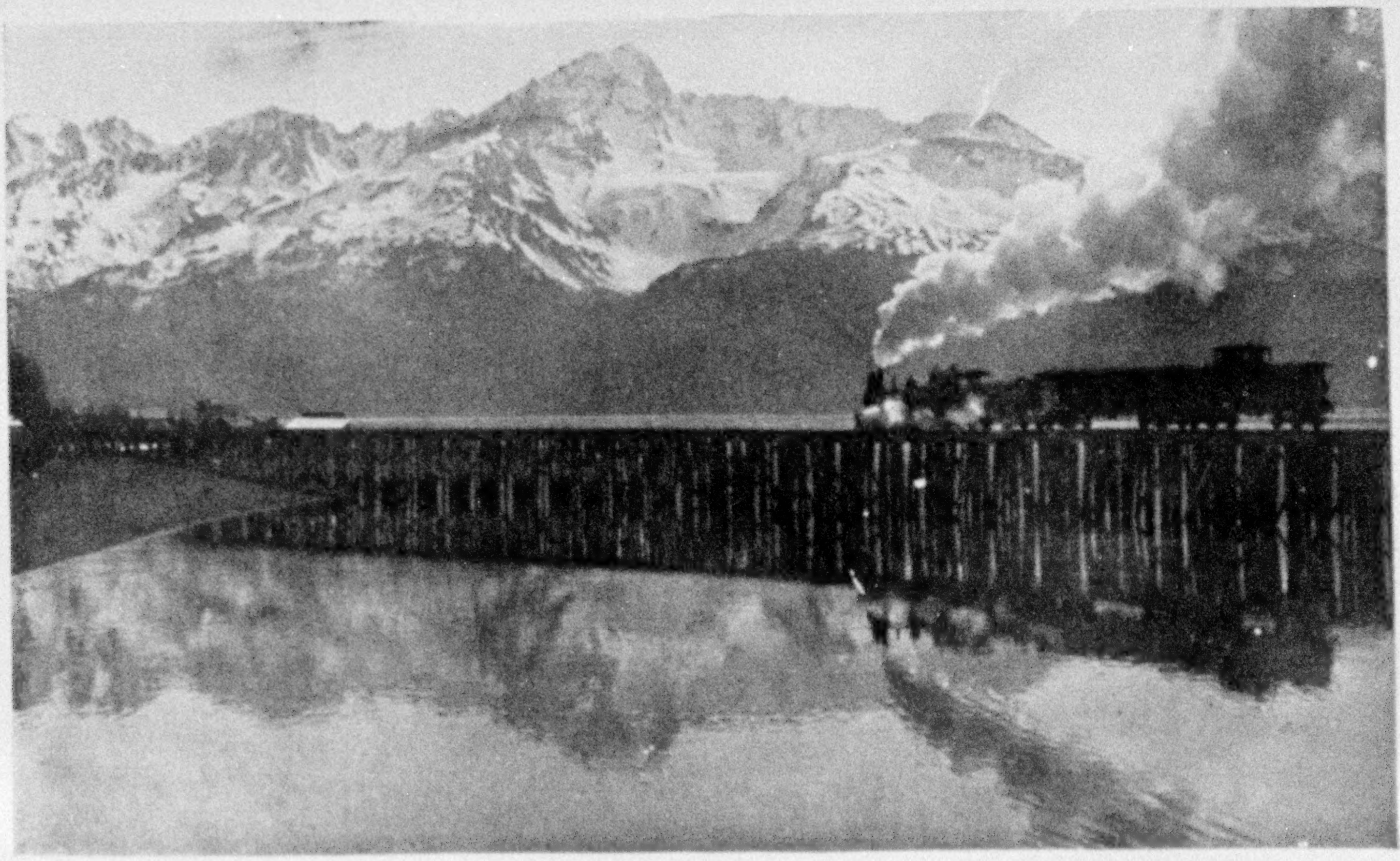
*See articles by George Shiras, 3rd, in the NATIONAL GEOGRAPHIC MAGAZINE, 1906 and 1908.



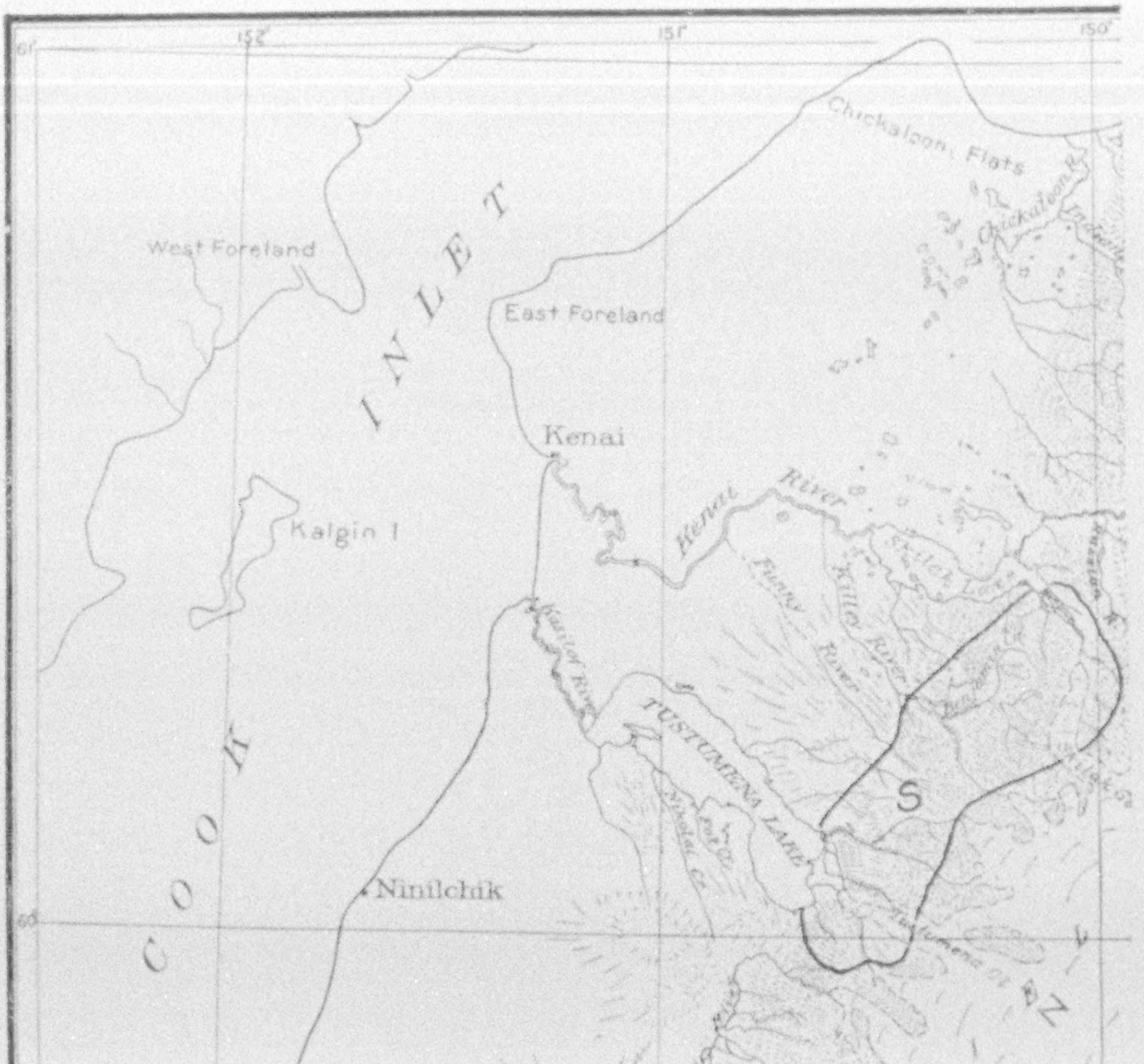
HEAD OF RESURRECTION BAY, SHOWING THE TOWN OF SEWARD

The cross to the north indicates the position of upper Kenai Lake, and 40 miles to the westward was the hunting ground of the author (see map, pages 428, 429)

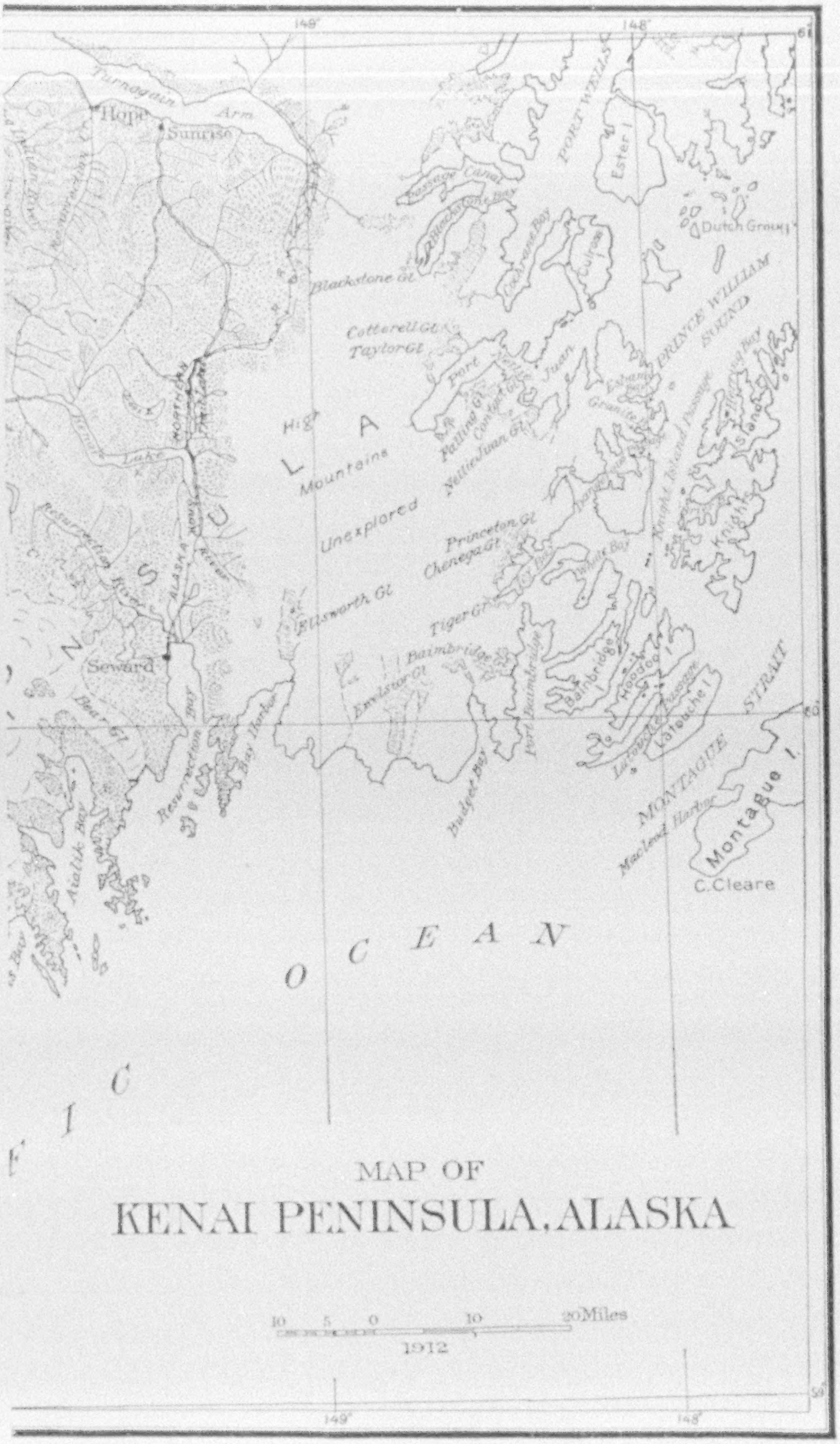


RESURRECTION BAY, SEWARD PENINSULA: STEAMSHIP DOCKS OF SEWARD, WITH TRAIN LEAVING FOR KENAI LAKE AND TURNAGAIN ARM (SEE PAGE 430)

XUM


152°
151°
150°
61°
60°
59°
Chickaloon Flats
Chickaloon R.
West Foreland
East Foreland
COOK INLET
Kenai
Kalgin I
Kenai River
Skilak Lake
Funny River
Killey River
Kasilof River
TUSTUMENA LAKE
S
Ninilchik
Tustumena Gl.
Northwestern
KACHEMAK BAY
Homer
Kasitsnah Bay
Seldovia
Port Graham
KENAI
NUKA BAY
Nuka I.
Pye Islands
Dog Salmon Bay
Port Chatham
Rocky Bay
Windy Bay
Chugach Bay
Elizabeth I
Pearl I
Chugach I
PACI

MAP OF KENAI PENINSULA, SHOWING THE BEST PORTION OF THE SHEEP COUNTRY (ENCLOSED IN A BLACK LINE AND MARKED "S")


MAP OF
KENAI PENINSULA, ALASKA
10 5 0 10 20 Miles
1912
149°
148°
60
59
Turnagain Arm
Hope
Sunrise
Resurrection
Blackstone Gl.
Cotterell Gl.
Taylor Gl.
Passage Canal
Blackstone Bay
Cochrane Bay
Culross
PORT WELLS
Ester I.
Dutch Group
PRINCE WILLIAM SOUND
Port Nellie Juan
Falling Gl.
Contact Gl.
Nellie Juan Gl.
Granite
Knight Island Passage
Knight Island
High Mountains
Unexplored
Princeton Gl.
Chenega Gl.
Ellsworth Gl.
Tiger Gl.
Bainbridge Gl.
Excelsior Gl.
Bainbridge I.
Hogg I.
Latouche I.
Latouche Passage
Port Bainbridge
Puget Bay
MONTAGUE STRAIT
Montague I.
Macleod Harbor
C. Cleare
Kenai Lake
Kenai River
ALASKA NORTHERN
Resurrection River
Seward
Bear Gl.
Resurrection Bay
Day Harbor
Aialik Bay
K E N A I P E N I N S U L A
P A C I F I C O C E A N

MAP OF KENAI PENINSULA, SHOWING LOCATION OF SEWARD AND RESURRECTION BAY. COMPILED BY R. H. SARGENT BY REQUEST OF GEORGE SHIRAS, 3RD tory birds, the big-game animals and smaller fur bearers, the minerals and methods of mining, and in the magnificence and variety of the scenery, represented in well-defined mountain ranges and isolated peaks, the foaming cascades, the giant glaciers and ice fields, the rivers and intervening lakes, and the hundreds of unexplored fiords of the eastern and southern shore.

Here and there snow-capped mountains drop to plateaux, rough and shaggy in crimson coats of moss or yellow-barked willows, and further down the green coniferous forests touch the tundra, dotted with glistening ponds, the feeding place for moose and the home of the black fly and mosquito.

Here during the summer solstice are weeks of brilliant weather and periods of wet and fog, while the frequent seismic disturbances give notice how superficial are the ice fields and the blizzards in a country of great volcanic energy.

Here is a mid-year season, when the calendar days are separated by an hour of twilight, and again when the trapper, in his sheltered winter cabin, cannot see the sluggard sun above the horizon of the surrounding mountains.

Here are tidal waves and rip-raps of Turnagain Arm, like those of the Bay of Fundy, and here so rare the atmosphere that at times Mt. McKinley, distant 200 miles to the north, can be seen from the higher mountain tops.

So many accurate and graphic accounts have been written of trips along the Alaskan coast that any effort to duplicate or vary the same may be dispensed with here.

On leaving Lake Superior and at the last moment I was obliged, owing to sickness in his family, to get a substitute for my old Michigan guide, John Hammer, who for 25 years had accompanied me on various trips. Charles Anderson, who took his place, had frequently been employed by me in various capacities, and possessed a fair knowledge of the woods and waters.

On July 8 we left Seattle for Seward, and had pleasant weather throughout most of the voyage.

Toward sunset on the evening of July 14 the steamer entered Resurrection Bay, which penetrates deeply into the Kenai Peninsula, forming the most wonderful harbor on the Alaskan coast and open throughout the winter, when the Great Lakes and connecting rivers are closed for many months.

After a run of ten miles between two snow-covered ranges paralleling the bay, we reached the town of Seward, and the first responding to the shrill and echoing whistle were a hundred or more dogs, of every breed and color, who amicably ranged themselves in several compact rows along the edge of the dock, in hopes that some portion of the garbage saved by the kindly steward would fall to their lot (see page 431). In their home grounds or street fronts these shaggy beasts maintain a dead-line against all canine intruders, but at the wharf there was no distinction based upon race, size, sex, or relationship. Whenever a steamer whistled at night, or any unusual noise aroused them, the wolf-like howl, rising and falling in chorus, told plainly of the near kinship of many of these to the gaunt and ravenous creatures of the forest and rocky gulches.

On disembarking we were met by an obliging inn-keeper and soon were in earnest confab with our local guide, Thomas B. Towle, who had just come in from his mining camp, on the upper Kenai River, with the information that a launch would meet us at the lake, two days later, on the arrival of the motor train.

At Seward so varied and reasonable are the supplies needed on a camping trip that little need be brought from the outside, while the courteous and reliable character of the inhabitants, private and official, makes the entry and return to this little town a source of pleasure and kindly recollection. In fact this may be said of most Alaskans, for their trials and struggles, like placer mining, have removed the rough and undesirable from their midst.

On the morning of July 17 we boarded a gasoline car of the Alaskan Northern Railroad, en route to the upper Kenai Lake, 23 miles to the north, while the canoe and bulk of the provisions were to be forwarded by freight several days later. The railroad in question extends

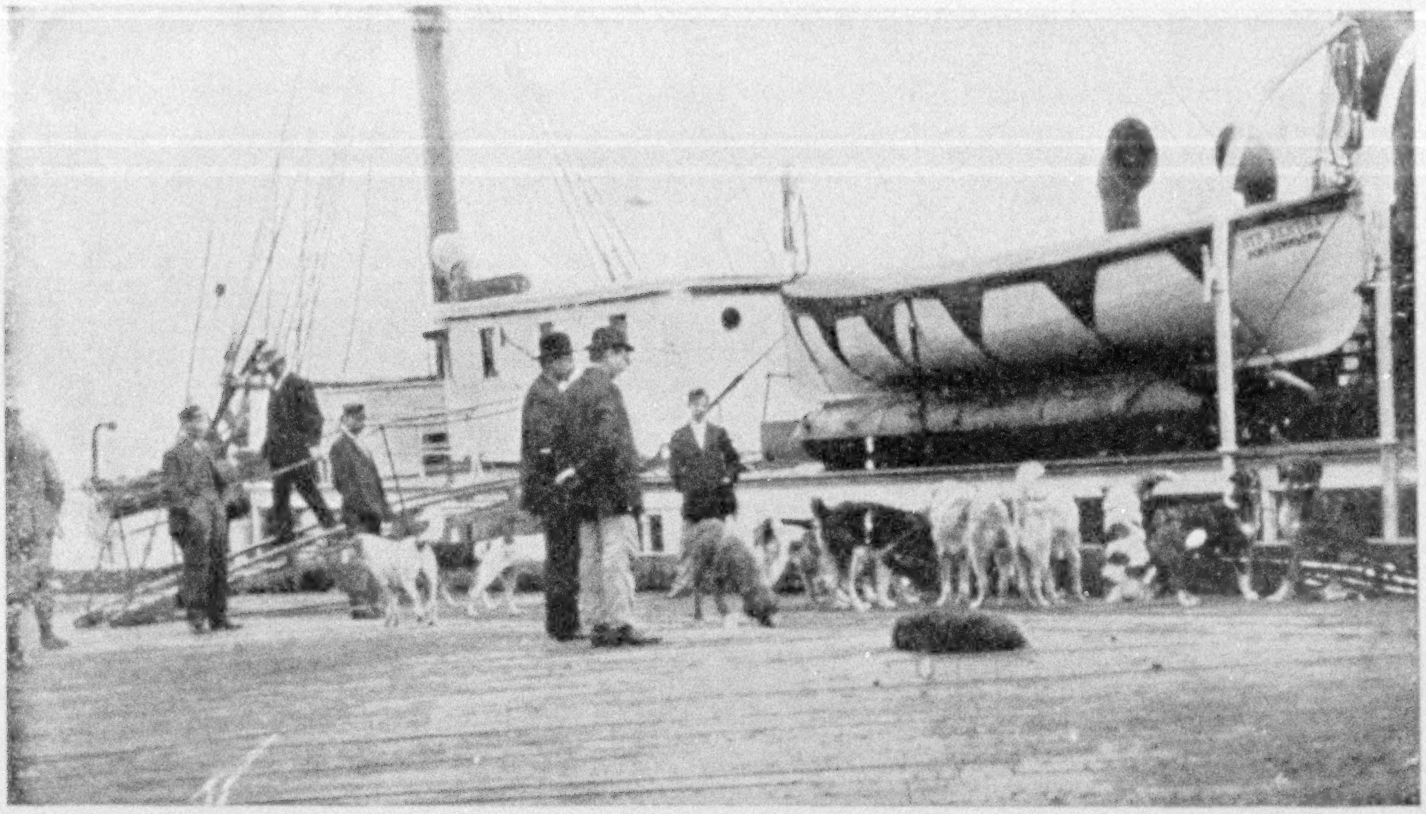


Photo by George Shiras, 3rd

WINTER SLEDGE DOGS LOITERING EXPECTANTLY AROUND STEWARD'S PANTRY (SEE PAGE 430)

to the end of Turnagain Arm, half way to the Matanuska coal fields; but, lacking sufficient capital and by reason of the withdrawal of the coal lands, is now in financial straits. However, it is a most convenient highway for hunters and miners, and if either of these lack the cash to pay the tariff of 20 cents per mile or are of an economical turn of mind, the roadbed affords a fine trail to the interior.

On arriving at the lake it took but a few minutes to load our stuff on a comfortable launch, and soon we were traversing a portion of the longest watercourse of the peninsula, which from the head of Snow River to Cook Inlet is 117 miles in length. The upper lake is 23 miles long, has a maximum width of 1.5 miles, and is 460 feet above sea-level. The upper Kenai River is 16 miles long, while the lower lake, usually called Skilak, has a length of 15 miles, is four or five miles wide, and 150 feet above the sea, its waters reaching the inlet after a tortuous run of 53 miles.

At the outlet of the lake we transferred the outfit to Tom's big flat-bottom skiff, and, dropping down the river several miles, went into camp at the mouth of Cooper Creek, to await the arrival of the canoe and provisions. The maximum temperature was 80 degrees at noon, followed by 87 degrees the next day—a most unusual record.

Seeing that the half-embedded boulders were sweating vigorously along the river trail, I predicted a big thunderstorm, and was warned that they were very rare in this region. But shortly after the rain came down in torrents and thunder echoed for hours throughout the valley; so I gained that distinction which comes with a lucky hit. This proved to be the only heavy rain of the entire trip, and thereafter clear days and a high temperature pleased and astonished us all.

STERN FIRST, DOWN THE RAPID KENAI RIVER

As usual on expeditions of this kind and where the supplies could be carried by water, my outfit was varied and heavy, for it is the height of bad management, when visiting a remote and unsettled country, to economize in money, time, or labor at the expense of a proper equipment or an ample supply of provisions.

Several hours were spent in loading the boat and canoe, with just a sufficient separation in kind to leave a complete but temporary outfit in case either craft was capsized on the run to the lower lake.

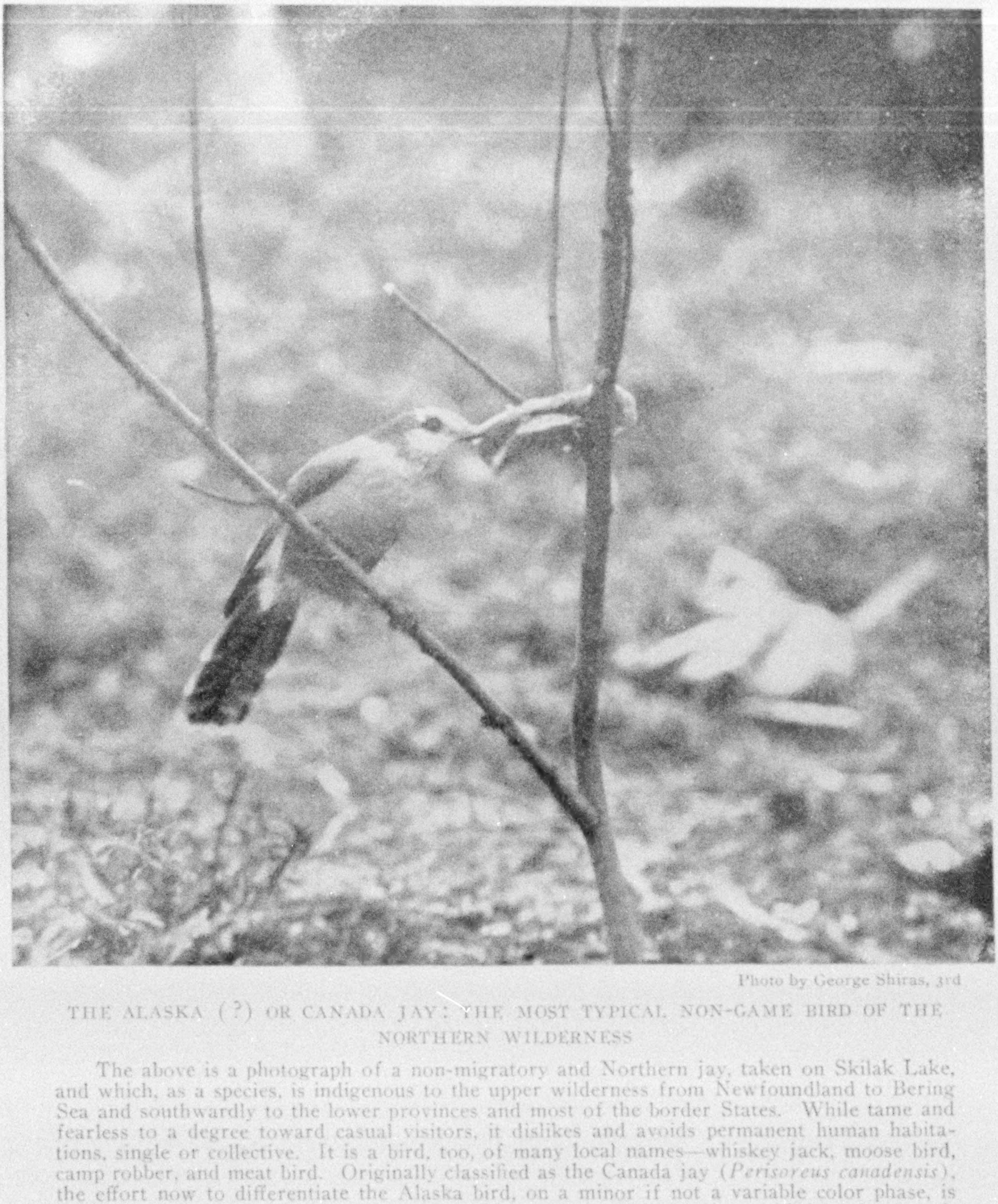


Photo by George Shiras, 3rd

THE ALASKA (?) OR CANADA JAY: THE MOST TYPICAL NON-GAME BIRD OF THE NORTHERN WILDERNESS

The above is a photograph of a non-migratory and Northern jay, taken on Skilak Lake, and which, as a species, is indigenous to the upper wilderness from Newfoundland to Bering Sea and southwardly to the lower provinces and most of the border States. While tame and fearless to a degree toward casual visitors, it dislikes and avoids permanent human habitations, single or collective. It is a bird, too, of many local names—whiskey jack, moose bird, camp robber, and meat bird. Originally classified as the Canada jay (*Perisoreus canadensis*), the effort now to differentiate the Alaska bird, on a minor if not a variable color phase, is regarded as a mistake by most lovers of the North woods. If there is any bird on the American continent of similarly extended distribution and localized environment which retains a greater and more remarkable uniformity in color, size, shape, habits, basic notes, diet, and disposition, the writer is ignorant of such. The sub-species, Labrador jay, ought to be the limit in this direction.

The clear, warm weather, with an unusual amount of winter snow remaining on the mountain ranges, had caused the river to overflow its banks. The rapid current now made it possible to cover the 16 miles to the lake in a few hours, and this condition had prevented any boat coming upstream for several weeks. It may be stated in advance that the hot weather continued until the first week in September, and so, on our return, it required four days of the hardest

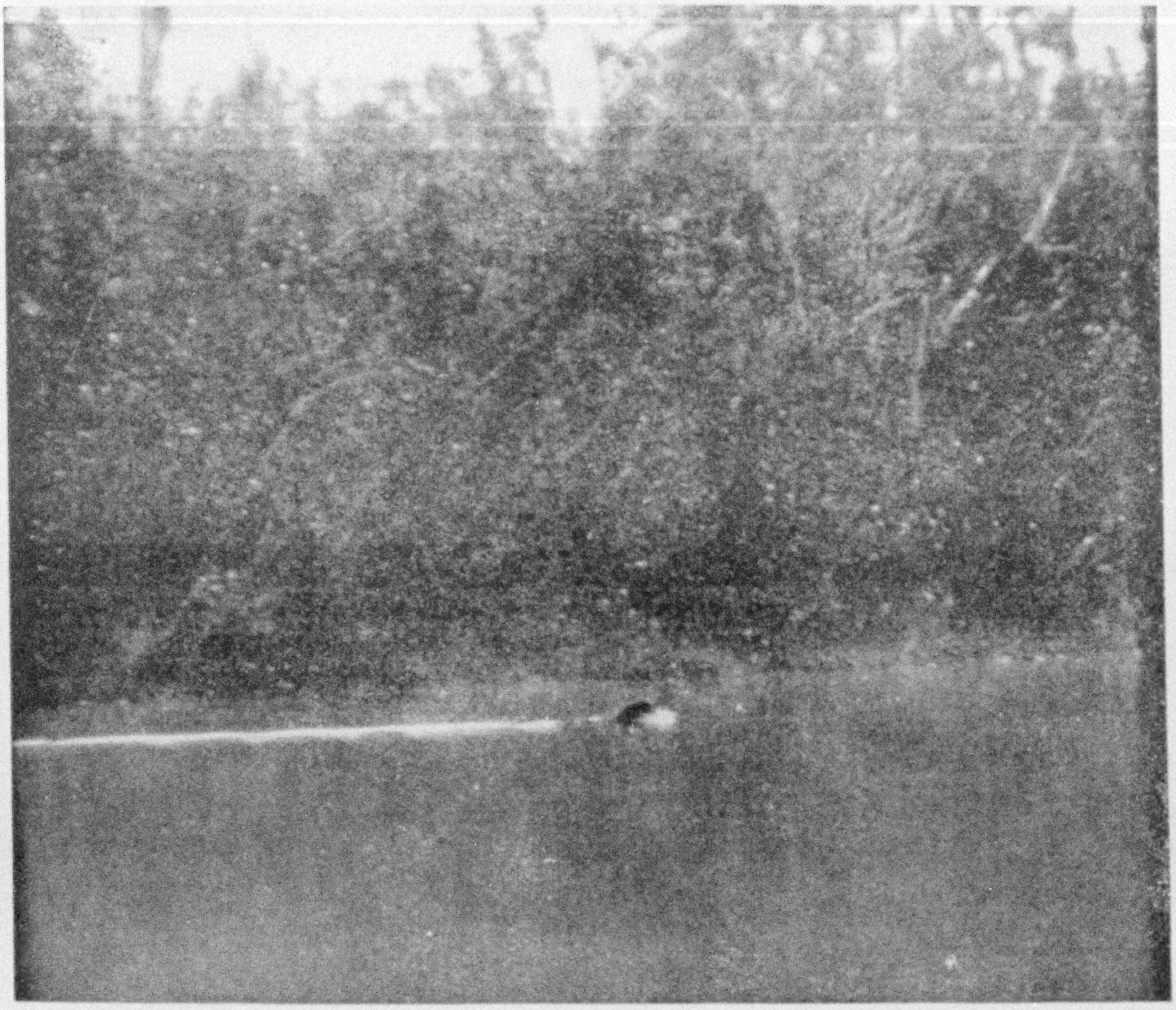


Photo by George Shiras, 3rd

OTTER SWIMMING IN A BAY OF SKILAK LAKE, SEEKING SALMON: THE OTTER SWIMS WITH HEAD HIGH OUT AND BODY SUBMERGED

kind of work to line up the skiff, the canoe having been abandoned in order that the three men might devote their energies to the larger boat.

And even at that date we were the first to get up the river, due wholly to Tom's skill and the energy of all.

On the short trip from the outlet of the upper lake to our first camp, at the junction of Cooper Creek and the Kenai River, I found that it was the invariable practice for all boats, big or little, to go down this stream stern first, and to me this was a new method of navigating swift and dangerous waters. Heretofore I had boated on many such Northern streams, originally in the frail and buoyant birch-bark canoe, in dugouts, and, later, in the modern canvas-covered cedar ones, or at times in the knock-down type, as well as having occasionally used the big, strong, sharp-pointed batteaux of the Hudson Bay and Newfoundland kind, which could plunge with impunity into the roughest water; or, when sufficiently manned, could be lined up any stream, irrespective of inshore rocks and snags.

But whatever the craft or the character of the water, bow first was the rule, except when a mishap in the breaking of an oar or the slipping of a rope decreed otherwise.

Therefore, to load down a small, frail, flat-bottom, square-stern skiff with 1,000 pounds of stuff and two occupants, and then start down the river wrong-end foremost, where every 100 yards or so

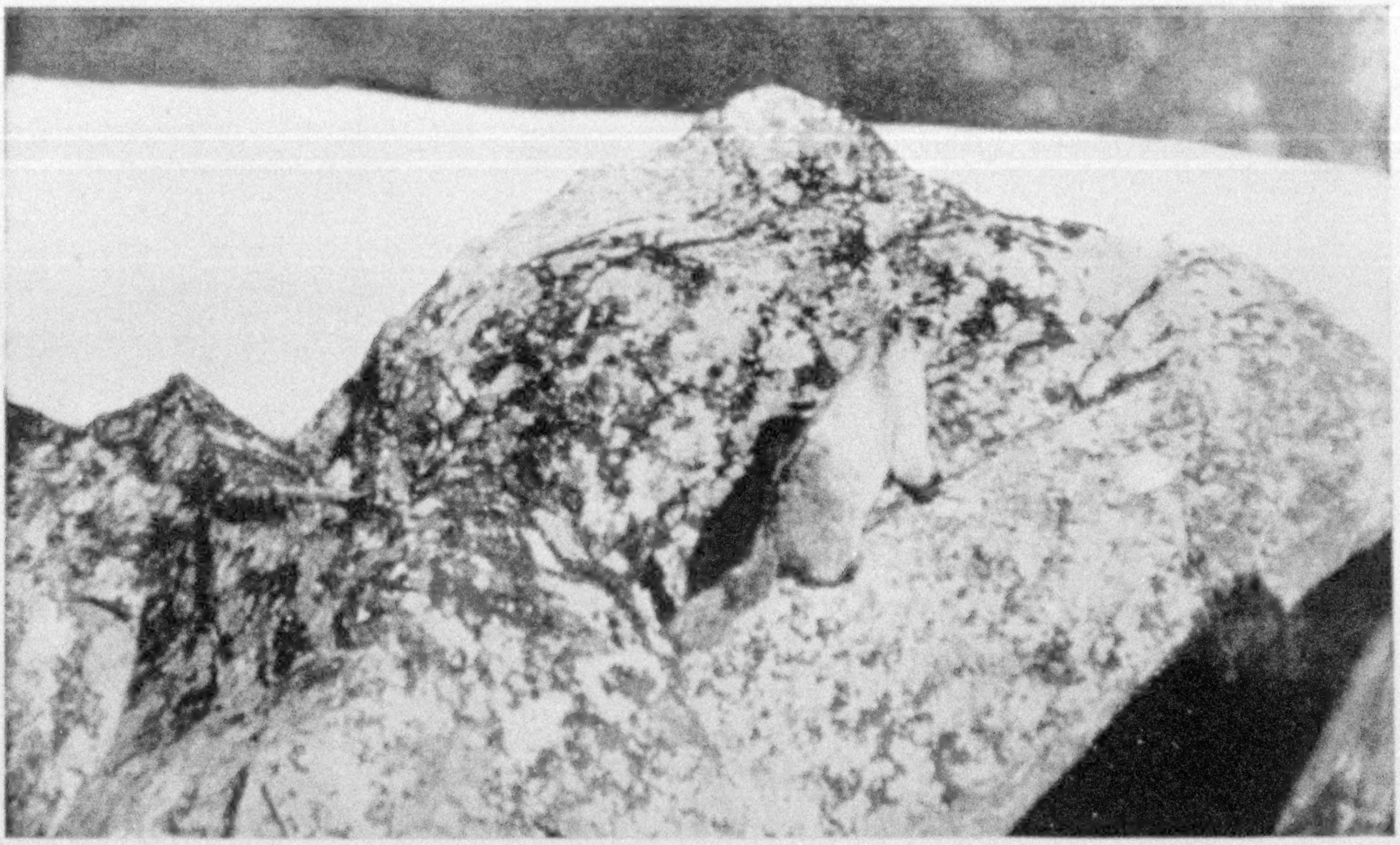


Photo by George Shiras, 3rd

A HOARY MARMOT

The northern type of the American woodchuck—a good example of protective coloration. Photographed on mountain at head of Benjamin Creek

the combers in the narrower channels, or cross-currents, throw the waves a foot or two higher than the stern of the boat, seemed inviting catastrophe, had it not been proven otherwise, seconded by the fact that Tom had the reputation of being the most capable and experienced riverman in the Kenai Valley.

Grave concern was expressed, however, over the safety of our canoe, and so the feeling of distrust was mutual. Tom said that he would rather take his chances on a saw-log, "Because it never took in water, and the part above the surface was always the top, no matter how often it rolled over." So here was a chance to try out the efficiency and safety of each boat, running practically side by side.

The explanation for this method of handling such a skiff soon became plain. No ordinary boat can safely run a swift and tortuous stream when floating at the same speed as the current. It must go either faster or slower, in order to respond readily to the rudder or paddle when steering. In a canoe the occupants of course face ahead, while by letting the skiff run down stern first the oarsman, and in this particular instance the steersman, also faced down the river, the full advantages of which I learned later.

Since the river was unknown to my Michigan guide, who was to manage the canoe, it was arranged that I should sit in the stern of the skiff, facing upstream, and, with the canoe keeping 50 yards or more in the rear, I could signal the character of the water at each bend and which side the canoe should take when necessary.

The first proof that the different methods were based upon the character of the boats came a few minutes after starting. On rounding a bend we found in the middle of the stream, less than 30 yards away, an immense rock, over which the water was breaking with great force and against which we would have drifted broadside, as the current divided. Tom pulled vigorously to the left, quartering upstream, and although he could not quite stem the current the boat slowly worked inshore, with a good margin to spare when we dropped past the rock. Had the boat been going

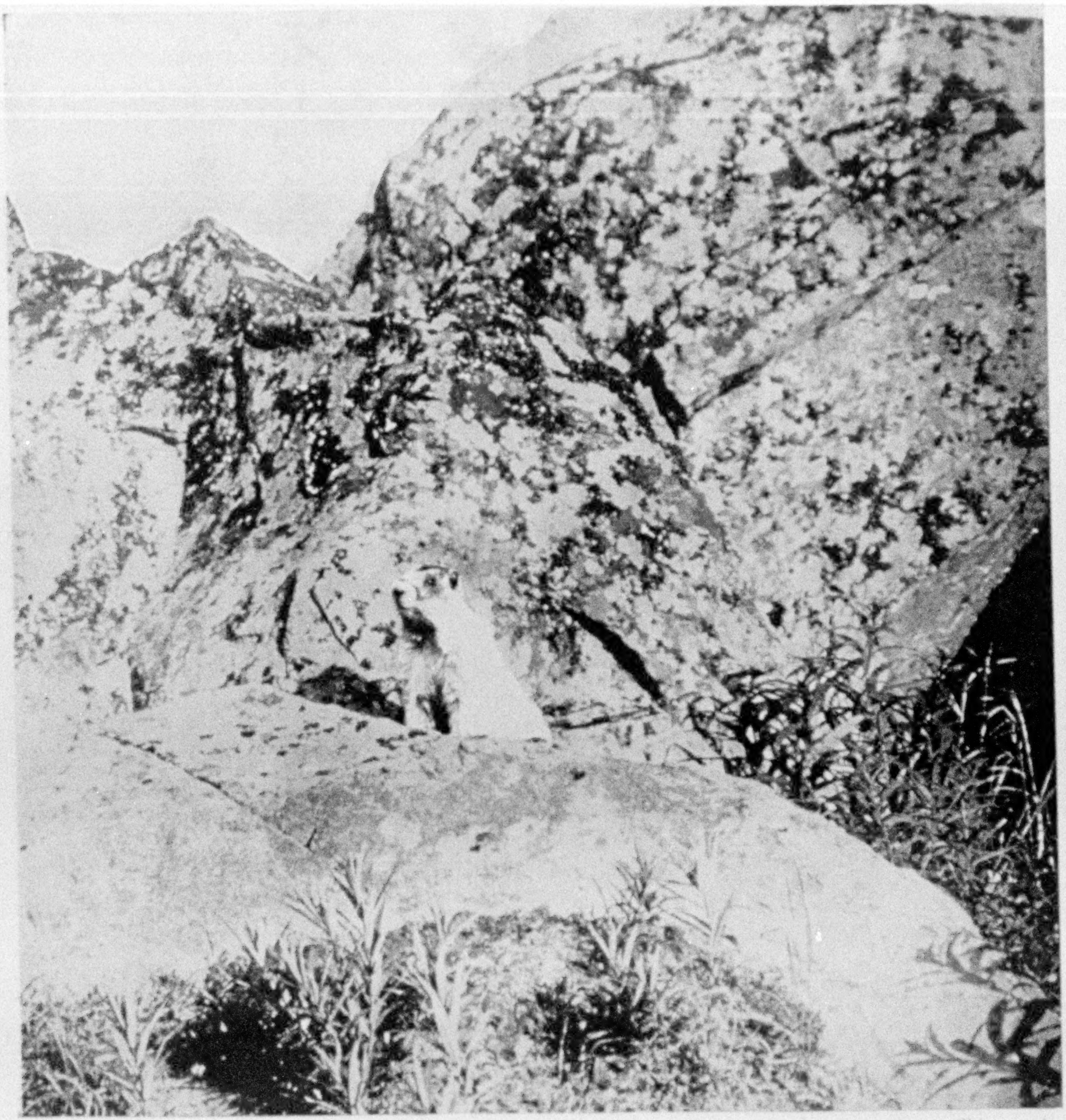


Photo by George Shiras, 3rd

ANOTHER VIEW OF THE HOARY MARMOT, RARELY FOUND BELOW TIMBER LINE

They have a remarkable system of signals on the approach of an enemy. This marmot had just signaled our approach with an almost human whistle, which was as clear as a bell. The whistle often confuses hunters who have been separated.

faster than the current, with the oarsman's back to the danger, a smash-up would have been a certainty. Charlie, on the other hand, in the light and easier-handled canoe, took the inshore channel with a few strokes of his paddle.

Thus the lighter boat depended upon speed and ease of propulsion, while the clumsy and heavily laden skiff, with Tom facing downstream, could be kept in the middle of the river or pulled to either side in time to avoid rocks or rough water.

I must concede, however, that there were times when the skiff thus handled had the advantage over the canoe, for when entering certain rapids, where the breakers extended from bank to bank, by pulling at the oars, and thus slightly checking the descent, the great curling

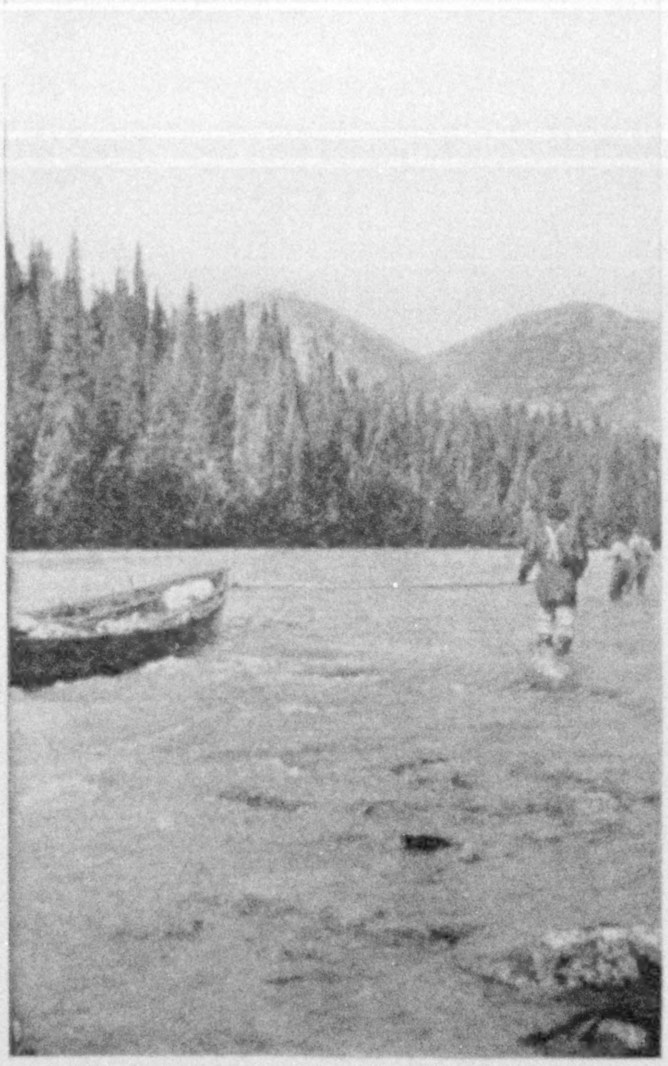


Photo by George Shiras, 3rd

TOWING OUR BOAT UP KENAI RIVER ON THE RETURN TRIP

The two men in front devote their strength to pulling on a rope, while the one in the rear, by the use of a 10-foot pole bridled to the bow, steers the craft in and out around snags and rocks in shallow water.

waves fell away harmlessly from the flat stern, because they were receding with the same speed as the current. At such times the canoe, drifting rapidly with the stream and often going much faster in order to keep its course, would be deluged with spray, and occasionally a large wave would overlap the bow.

To those who have occasion to run swift and crooked streams, where the backwoods craft is apt to be one of the easily constructed, box timbered kind, this method can be highly recommended as safe and comfortable. Were such a method in vogue on other Alaskan rivers many a miner's life would have been saved and many a valuable cargo carried safely to its destination.

At a box canyon, some three miles above the lake and where the river runs like a mill-course between high and perpendicular cliffs for nearly a quarter of a mile, we portaged over the canoe and our more valuable stuff, since I was unwilling that any risk be taken. A week before a large boat, containing government supplies, was nearly lost at this point and, half filled, floated helplessly down the stream.

When making this portage it became apparent that we had reached the first great fall and winter range of the moose, for the numerous and well-worn runways, the trees denuded of their bark and lower branches, together with an occasional shed antler, told the story.

Here we camped for the night, near one of the few sloughs connected with the river, in hopes of a moose picture or two, but the high stage of water and the fact that the most of these animals were then at the edge of the timber line or in the great swamps west of the river valley only resulted in giving the mosquitoes an unexpected but welcome meal.

Shortly after starting the next afternoon the canoe, in making a quick rush to avoid going under a log jamb, got ahead of us, and when overtaken, ten minutes later, we found Charlie clinging to a bush with one hand and bailing out with the other, having kept to the middle of the stream when rounding a sharp bend, thereby running into what the natives call "smoky water," which adventure might have been avoided had we been in advance or had he known the river better. When asked about the matter, he cheerfully remarked that it was now plain why Tom had given him all the canned goods—"because they were water-proof."

PICTURESQUE SKILAK LAKE

Finally, the boats came to the first slack water and the next turn showed the lake, higher by several feet than usual at this season, but smooth and glowing in the quiet hour preceding sunset. For the first time the oars and paddles became necessary for locomotion and, relieved from the continuous strain of watching for rocks, log jambs, rough water, and tumultuous whirl-pools, we enjoyed the placid surroundings to the utmost.

Dividing the mouth of the river was a low sandy island ablaze with a solid body of crimson flowers, while a semi-circular shore, with a yellow ribbon of sand, was backed by a green fringe of spruce, and on either side towered snow-capped mountains, extending half way down the lake, where rounded and rolling hills sank into a great flat, extending to Cook Inlet on the west and Turnagain Arm on the north. A wide valley on the left, with a muddy floor, resembling a former river-course, and through which there trickled several small streams, Tom said was the outwash plain of a great glacier, beginning a few miles back and extending, he thought, 65 miles to the southwest, but about which little was known or at least recorded. His statement immediately aroused my interest, and during the succeeding days I learned much about the great ice field from which the Skilak glacier flowed; so that on my return to Seward, and later to Washington, I was able by dint of much inquiry to learn something further of its history, with a view of suggesting in a general way the possibilities of its origin and its probable status among the great ice fields of the northern continent.

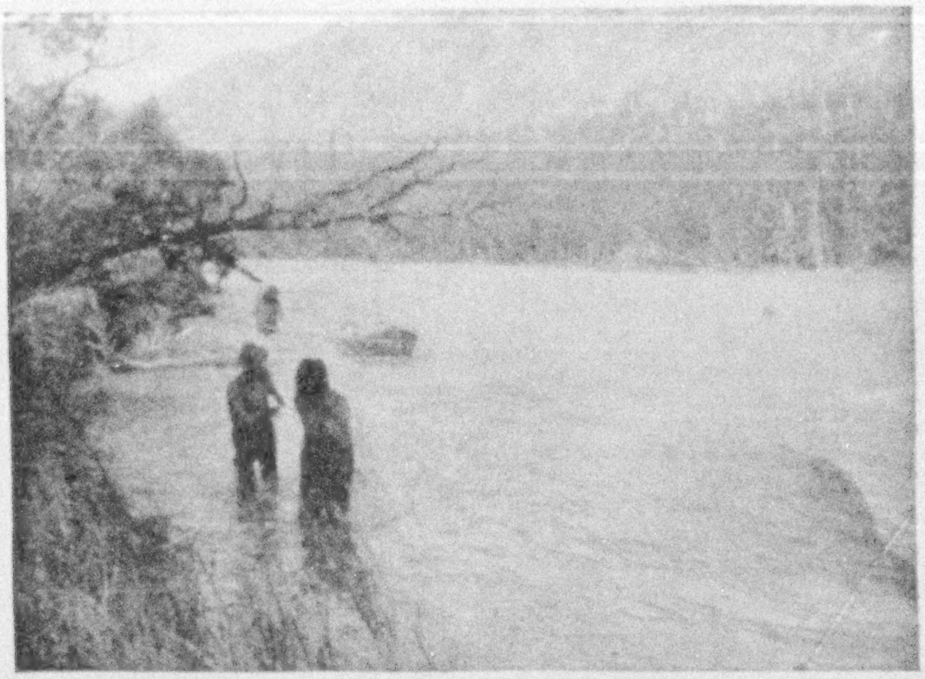


Photo by George Shiras, 3rd

THE WORST PART OF TRACKING: REQUIRING THE MEN TO WADE IN SWIFT WATER OF UNCERTAIN DEPTH TO AVOID LOG-JAMS AND OVERHANGING TREES

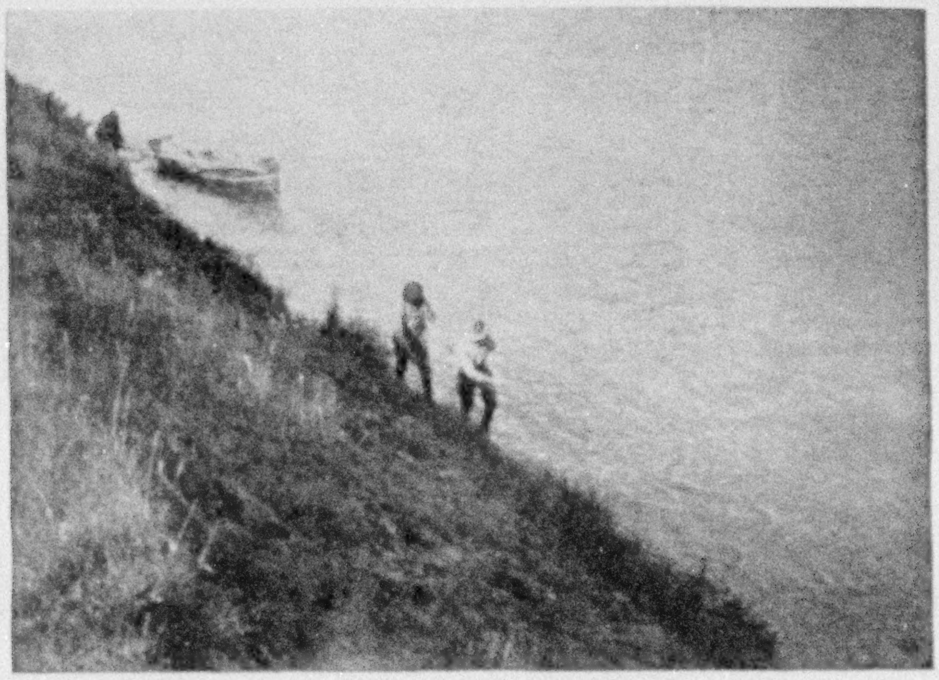


Photo by George Shiras, 3rd

AN EASY HALF MILE, WHERE THE ORIGINAL FORESTS ON THE BANK WERE CUT DOWN BY RUSSIANS IN 1857

Continuing down the lake, Tom pointed out what he called a "low divide" in the southern range, saying it was the gateway to the sheep country, 10 miles or so in the interior. In the setting sun the distant patches of alders and matted forests looked like smooth greenswards on gently sloping sides and the climb appeared easy—an impression, however, which changed considerably when we came to struggle for 3,000 feet up the precipitous sides, where the feet became imprisoned in gnarled limbs and the packs were continually catching in the stiff and unbreakable branches of the dwarf hemlock.

GULLS AND CORMORANTS

On reaching the lake we had studied its general contour, and estimated the distance to our first permanent camping site to be some 10 miles to the south-

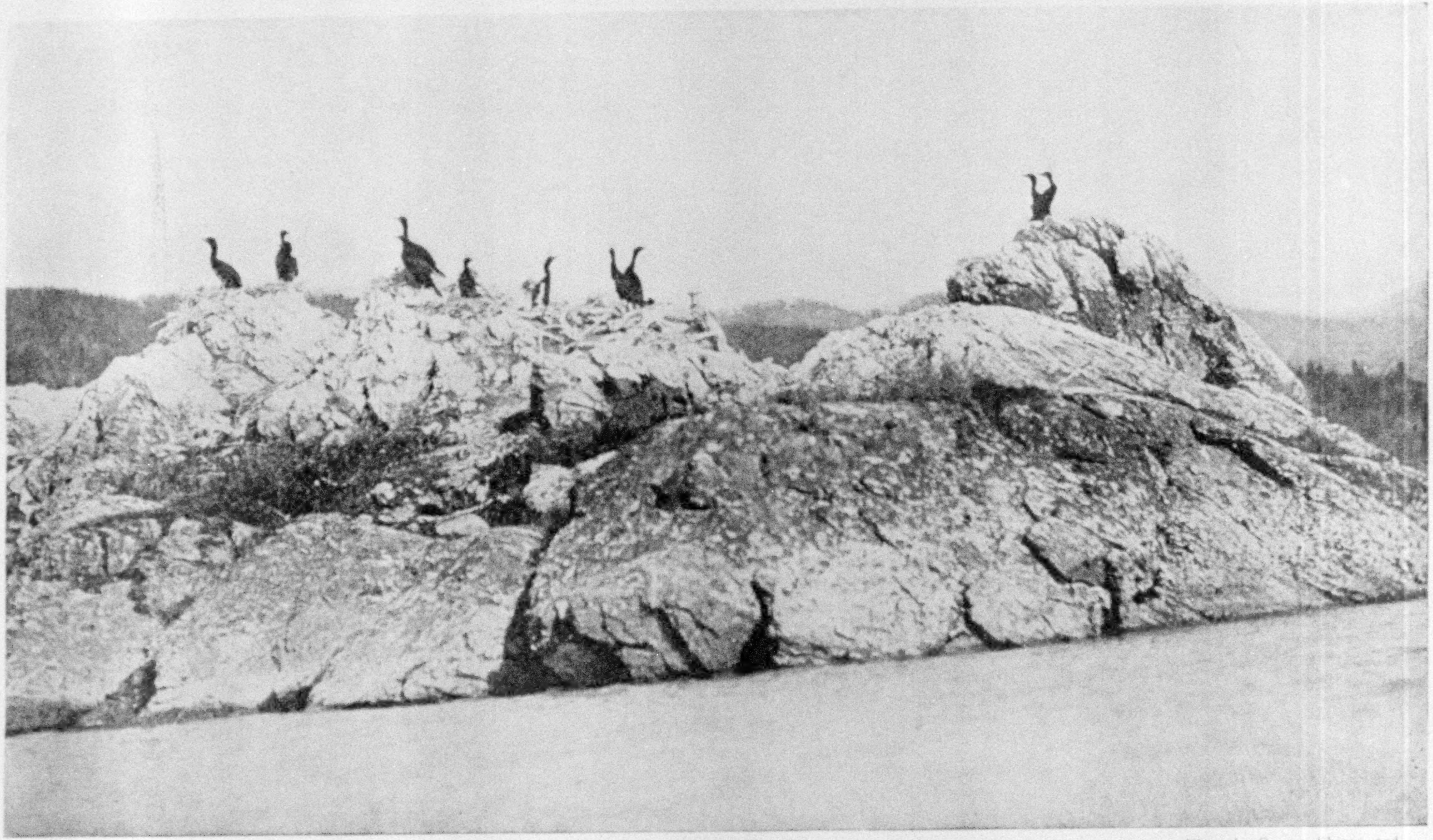


Photo by George Shiras, 3rd

BREEDING ROOKERY OF THE BLACK CORMORANT

One of two rocky islets near the eastern end of Skilak Lake, one being occupied by cormorants exclusively, and the other by gulls and terns. Note that the cormorants, on skyline or rock background, are not protected by their coloration, unlike the gulls, who are so protected (see page 444)

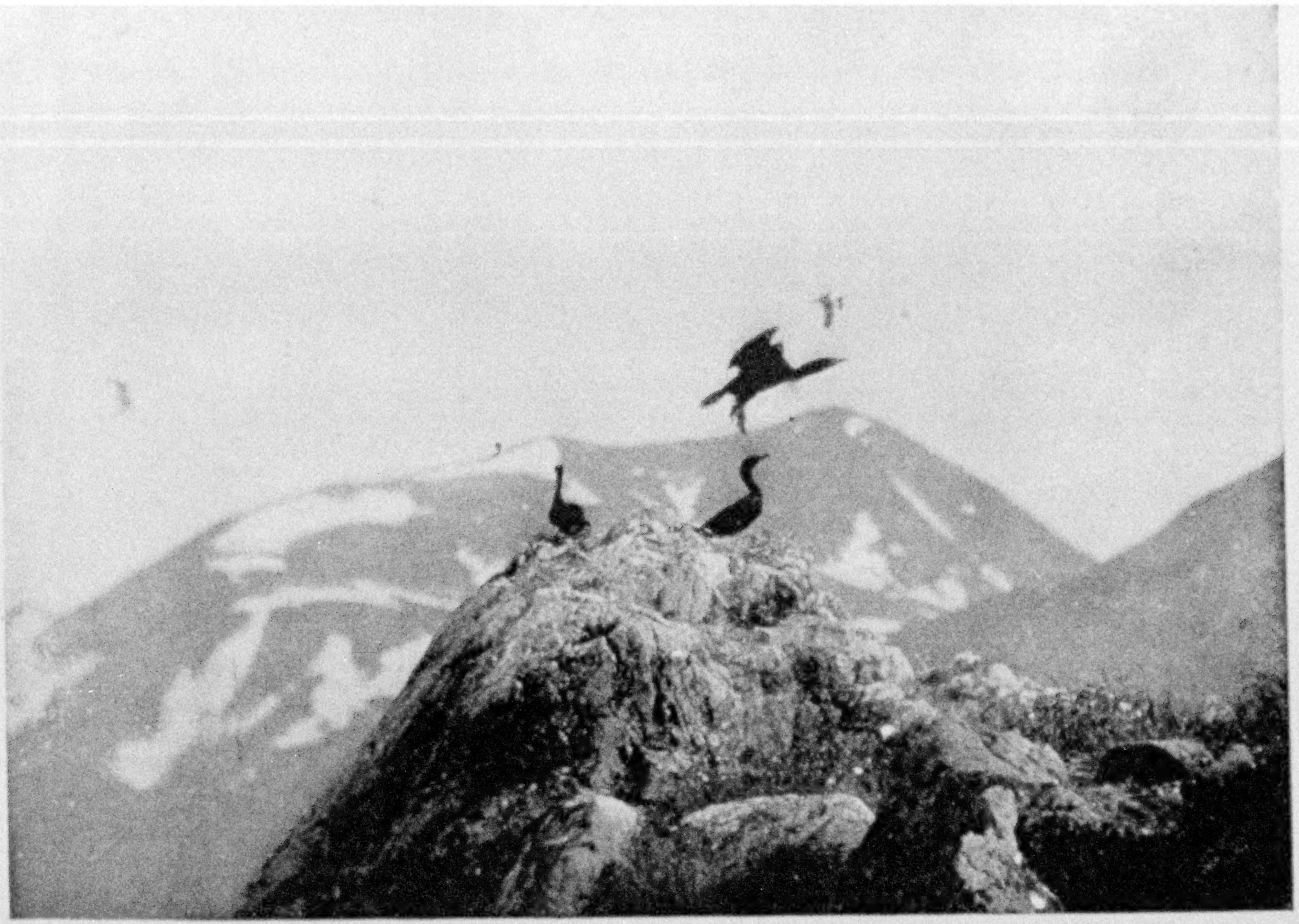


Photo by George Shiras, 3rd

NEST OF CORMORANTS ON A PINNACLE OF THE ISLAND: THE MAIN SHORE BEHIND SHOWS THE SNOWFIELDS CLOSE TO THE SHORE OF SKILAK LAKE

west. My desire to remain for one night at the upper end of this fine body of water was strengthened by observing two rocky islets ahead, over which gulls, terns, and cormorants were flying in considerable numbers. When passing by these, many nests were seen, and in a few minutes the boats were beached in a sheltered bay just opposite the islands.

Here, growing in the shallow waters, we collected our first wild onions and, erecting a single tent on the sandy shore in order to escape a hoard of mosquitoes buzzing in the forest behind, we spent a rather uncomfortable night, but entertained by the shrill cries of the gulls and the weird grunts and groans of the black cormorants. Shortly after sunrise the bird islands were visited, being escorted to a landing place by a great flock of protesting parents.

While the gulls and terns continued to circle just overhead, the cormorants flew a short distance on heavy wings, dropping into the lake to watch with anxiety our visit to their nursery. Some of the scenes are recorded in the accompanying pictures, with explanatory foot-notes.

THE GIANT MOOSE OF THE KENAI PENINSULA

Continuing along the high and rocky northern shore seven miles, and finding the direction of the wind favorable, though a considerable sea was running, we crossed the lake, where it was about four miles wide, to a beautiful little beach flanked by a grove of open pines, the site selected for a two weeks' camp, and situated at the end of the longest and most sheltered bay on the lake (see page 447).

The distance across the base of the western promontory was less than 75 yards, so the canoe was carried over, and during the remainder of the stay we had boats in adjoining bays, thus saving considerable time, according to the direction taken in our trips by water, besides affording a lee shore for one boat or the other, an important feature in a country where furious gales suddenly spring up in response to local conditions and seldom

Photo by George Shiras, 3rd

TWO YOUNG FEATHERLESS CORMORANTS IN NEST, ABOUT 8 DAYS OLD: THE SMOOTH AND SHINY BACKS AND THE BLUNT HEADS MAKE THEM RESEMBLE TURTLES

forecast by the barometer. For the then and future identification, we called this Double-bay camp.

The erection of the tents, the manufacture of camp furniture, and the setting up of the light sheet-iron Klondike stove took the remainder of the day.

Towards evening I ventured back into the forest to look for signs or the sight of a moose, for we were now in the home of the *Alce gigas*, and the several large runways on either side of the tents showed that we were then trespassing upon one of the main thoroughfares around the lake. But no fresh signs of any kind were found.

At dusk the guides saw, from a near-by knoll, five moose wading in the shallow waters of a pond a mile and a half distant. This sight went far to sustain the information upon which the present camp was located.

Selecting a good game country does not of itself imply individual success, though of course the main element in such. All wild animals of the larger kind have a particular range, or cover, in an extensive region, and quite often change these systematically, according to the season, or arbitrarily, according to the conditions of the weather and food supply. Therefore, before starting for Alaska, it was deemed no more important to go to a good game region than it was to go to the best part of it, for the allotted time was too limited for determining the latter by personal investigation. It is the too frequent lack of this kind of foresight which so often brings bitter disappointment to hundreds, who feel assured of success simply because of their entry into a country reputed to be swarming with game.

If my advance information were correct—and it came from several sources—it meant that I would find, to a certainty, more or less moose in an area of less than a square mile, and at a period of the year when they were hardest to locate, while the white sheep were to be

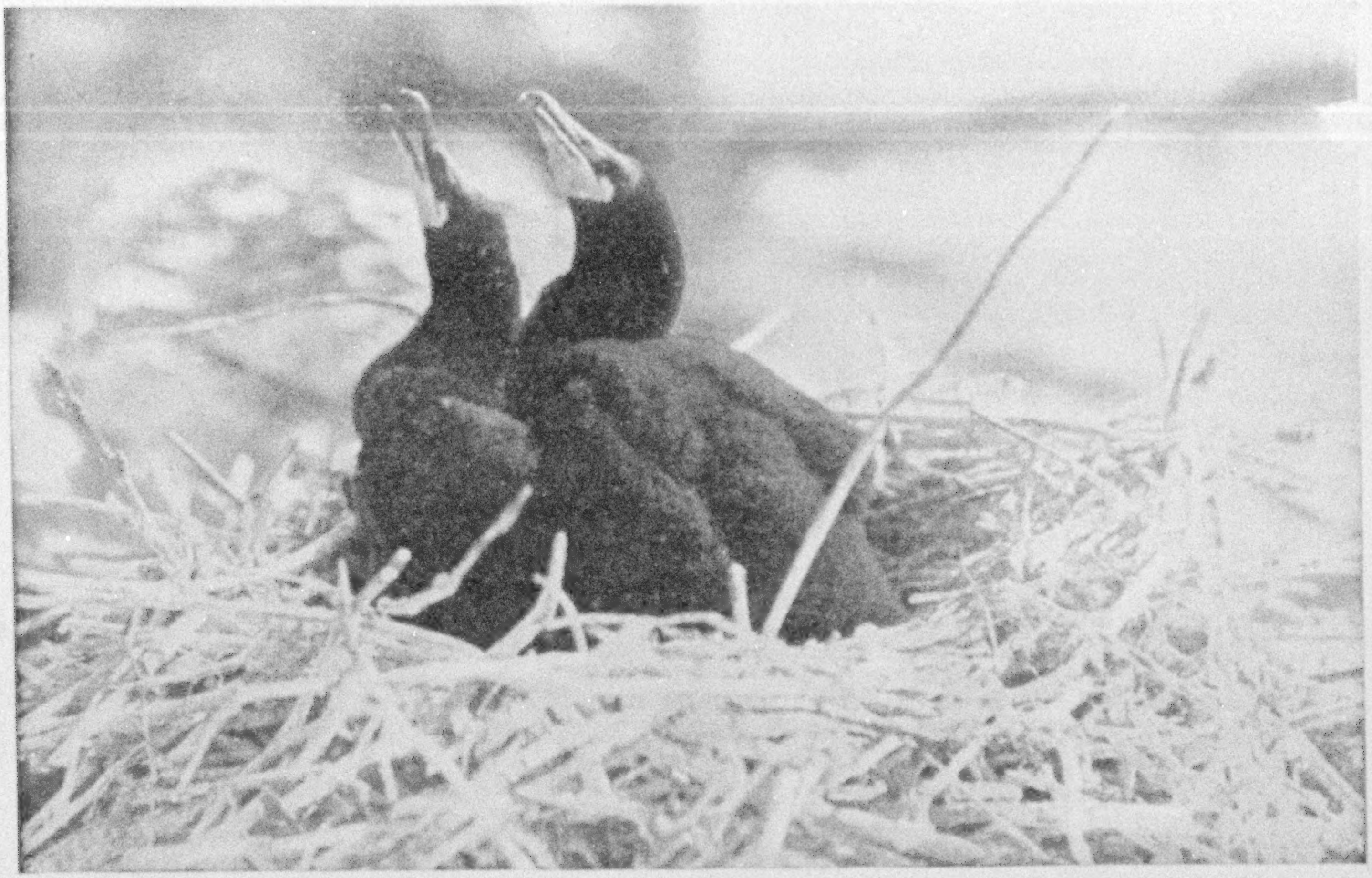


Photo by George Shiras, 3rd

HOW THE SAME TWO CORMORANTS LOOKED ONE MONTH LATER

looked for in several converging ranges, all under easy scrutiny from a single point of observation. And, in regard to the moose, this requires an explanation.

In all my journeys to the wilderness home of hoofed animals, I have only occasionally found an extensive region without animal licks, those resorts where the mineralized waters or soil attract ruminant quadrupeds. True, many of these spots are unknown, even locally; but nevertheless some hunter or explorer frequently knows of such places. And here the game photographer should locate for a while, however much a true sportsman may decry the destructive custom of killing the visiting animals at a lick, be it natural or artificial.

Some day I hope to summarize the result of an extensive investigation of hundreds of these licks, many of them thousands of miles apart, and frequented at different times by deer, caribou, elk, moose, sheep, goats, buffalo, and antelope. Just what elements attract and how each mineral affects them, physically and in their habits, presents many interesting phases (see pages 443 and 448).

It will suffice here to say that salt, soda, iron, and sulphur, in the order given, either singly or in combination, cover practically the attractive qualities of these licks. It is certainly very strange that such an interesting subject has never received any serious and comprehensive treatment by sportsmen or scientists.

An Eastern sportsman had informed me that a mile or so west of the present camp there was a good-sized lick, and, from the signs about it, he judged that a number of moose visited it, even in the summer time. As Tom had been his guide, I knew there would be no trouble finding it. However, I was told, on reaching Seattle, by a member of the party first attempting the ascent of Mt. McKinley, of a large lick less than 100 yards from the south shore of the lake, and in the same general direction as the other one. It was therefore apparent that, while neither of my informants knew of both licks, they were evidently in the same drainage basin and not more than a mile apart.

Feeling satisfied it was near the shore lick the guides had seen the five moose, and as it would be accessible by canoe and less disturbed by tramping about on

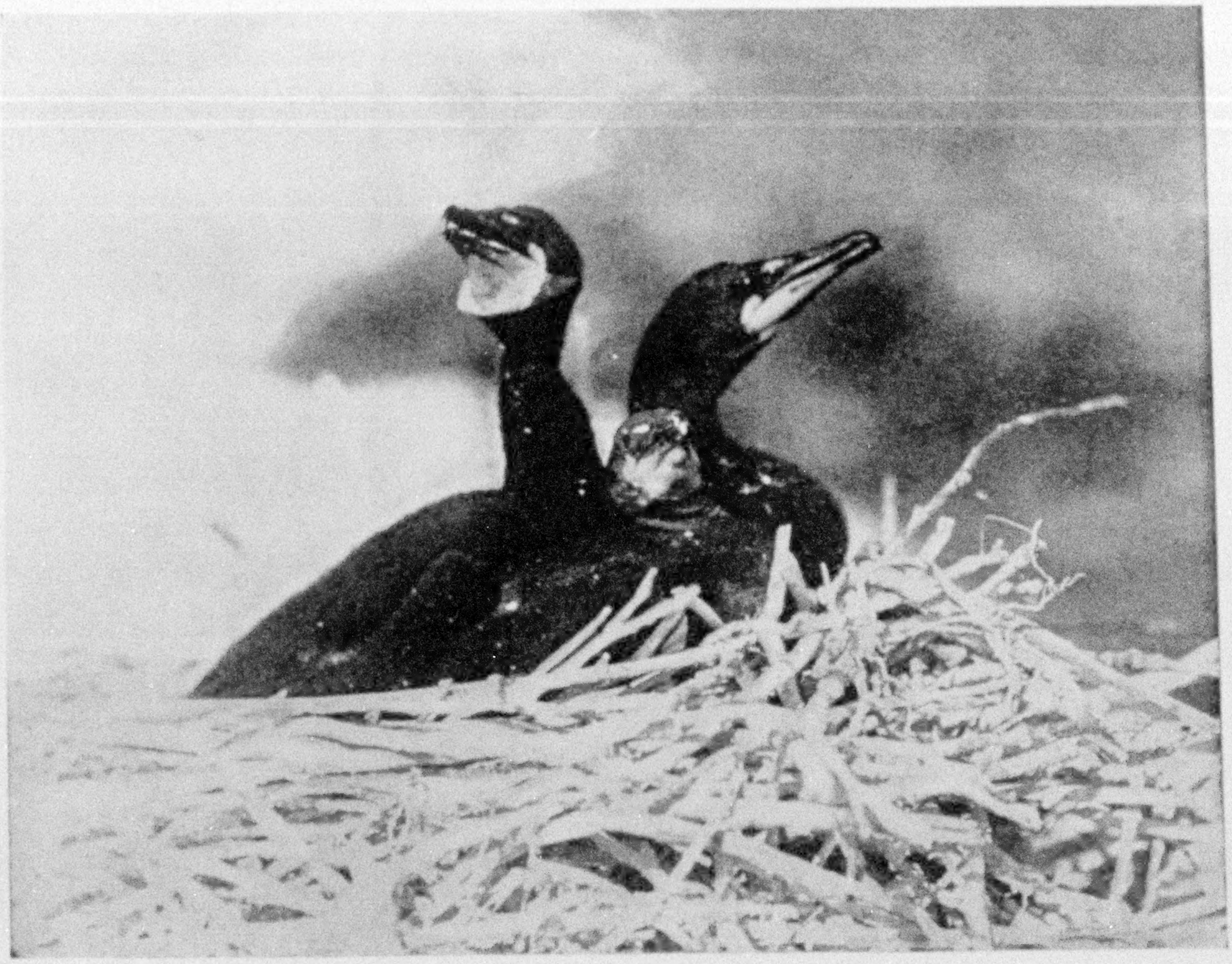


Photo by George Shiras, 3rd

ANOTHER NEST OF THREE CORMORANTS, 10 DAYS OLDER THAN THE TWO IN THE PRECEDING PICTURE

Unlike young gulls of a much younger age, they do not leave the nest when alarmed, but groan and disgorge the contents of their stomachs. The cormorants in this picture disgorged two quarts of fish from their pouches when the author appeared to photograph them.

land, I made up my mind that this would be the place where the spruce blind should be erected and my first efforts made in getting pictures.

OUR FIRST SIGHT OF THE GIANT ALASKA MOOSE

What happened the following day is described in extracts from my notebook:

"*July 24, 1911—Ther., 68-50.*

"At 9 a. m., in a bright sun and a dead calm, we started to look for the moose lick near the shore, and situated, according to directions, at the westerly base of a long point, which I took to be the one heading towards the lower end of Caribou Island. In half an hour the canoe entered the channel between the island and the point, and in a few minutes we swung around towards the bite of the bay. Tom said that the previous winter he had run 14 moose, principally bulls, off the island while crossing the ice with a dog-sled carrying provisions from Cook Inlet to a mining camp, but he did not think we would see any bulls now, as they were all hiding in the thickets well up towards the mountain-tops.

"A moment later he whispered, 'Gee! there's a bull, and a big one, too.' What I had taken for the brown soil on the roots of an overturned tree was a large moose with antlers that excited attention, but no more so than the tawny color of its coat. I had never seen such horns before nor such a color. The moose was solemnly watching the canoe, with the greater portion of the antlers shoved up into the lower branches of a spruce.

After examining him carefully through a powerful field-glass, I was about to prepare for a picture when Tom, who had been gazing about, said, 'Gee! Two more bulls! Look to the left.'

"And there, coming in file towards us, were two big brown-coated beasts with antlers that would tickle a Maine hunter, but somewhat smaller than those of the first. Sinking back into the bow of the canoe, I got the camera ready for the pair.

"But with that perversity with which providence is well supplied, the bulls turned towards the bigger one and for a moment or two rubbed noses in a friendly way—the climax of my opportunity, but missed by overcaution—when they passed to the rear and soon out of sight. They had doubtless been disturbed by us further down the shore. But the big fellow, motionless as an image, still gazed at the three heads peering over the edge of the grass."

And here it may be interpolated that no antlered animal of the earth is more obtuse and stolid than the moose, and no animal, when finally alarmed, is a greater victim of an increasing and progressive fear than this. At times it seems almost impossible to alarm them, and then, when this is accomplished, one wonders whether they ever recover from the shock.

Twenty years' association throughout their general range, with dozens of pictures by daylight and a hundred taken under the blazing, roaring flashlight—some only 20 or less feet away—make such conclusions irrevocable in the writer's case, whatever others may say regarding the supposed sagacity of the moose and the alleged skill required in accomplishing its undoing.

"Getting out of the canoe, I counted on a picture as he swung clear of the tree; and, walking slowly, got within 50 feet, when he backed a few yards and then peered under the branches from the other side. Taking a picture in this unsatisfactory position, I again advanced, when he slowly turned about and walked away with the spruce intervening.

"Somewhat disappointed, I returned to the water, and, when about stepping into the canoe, noticed the bull was coming back, and in a minute he was gazing once more through the branches of the spruce; but as it was now time for his noonday rest, and since he evidently was determined to see the thing out in a comfortable way, he unconcernedly lay down, and then for the first time I was able to see, in all their symmetry, the great horns just above the top of the high grass.

"This led to a change in my plans, and, detaching the smaller and faster lense, I got out a big telephoto for the purpose of obtaining, by a slower exposure, a picture of the great antlers. Armed in this way, I began a slight advance to where the footing would be firmer, when he got up with considerable energy, and all I could see on the focusing mirror was his slowly retreating rear—an unattractive target for the camera, however vulnerable to a ball projected by a modern rifle.

"Thus three big bulls had, in the course of ten minutes, offered easy shots to the veriest tyro, while a picture, worthless beyond its power to recall the scene, was the result of my first encounter with the giant moose.

"Pleased by the prospective and disappointed somewhat by the retrospective, a search for the lick was then begun, which I felt sure was not far away.

THE BIG MOOSE LICK OF SKILAK LAKE

"A short distance beyond the canoe, in the left-hand corner of the little bay, we found a mud-hole around which the grass had been trampled for some weeks, and the riled condition of the water showed that one or more moose had been there within a few hours. Looking beyond and through a fringe of trees, I could see a big bare field, the surface of which was plainly several feet below the surrounding marsh. Familiar with similar conditions, I felt certain that this was one of the greatest resorts of its kind I had seen in many years, for every inch of soil removed was either eaten or swallowed in the process of guzzling the mineralized water, oozing out here and there and covering a considerable part of the surface (see page 448).

"It was plain, too, on closer inspection, that the long drought had begun to affect

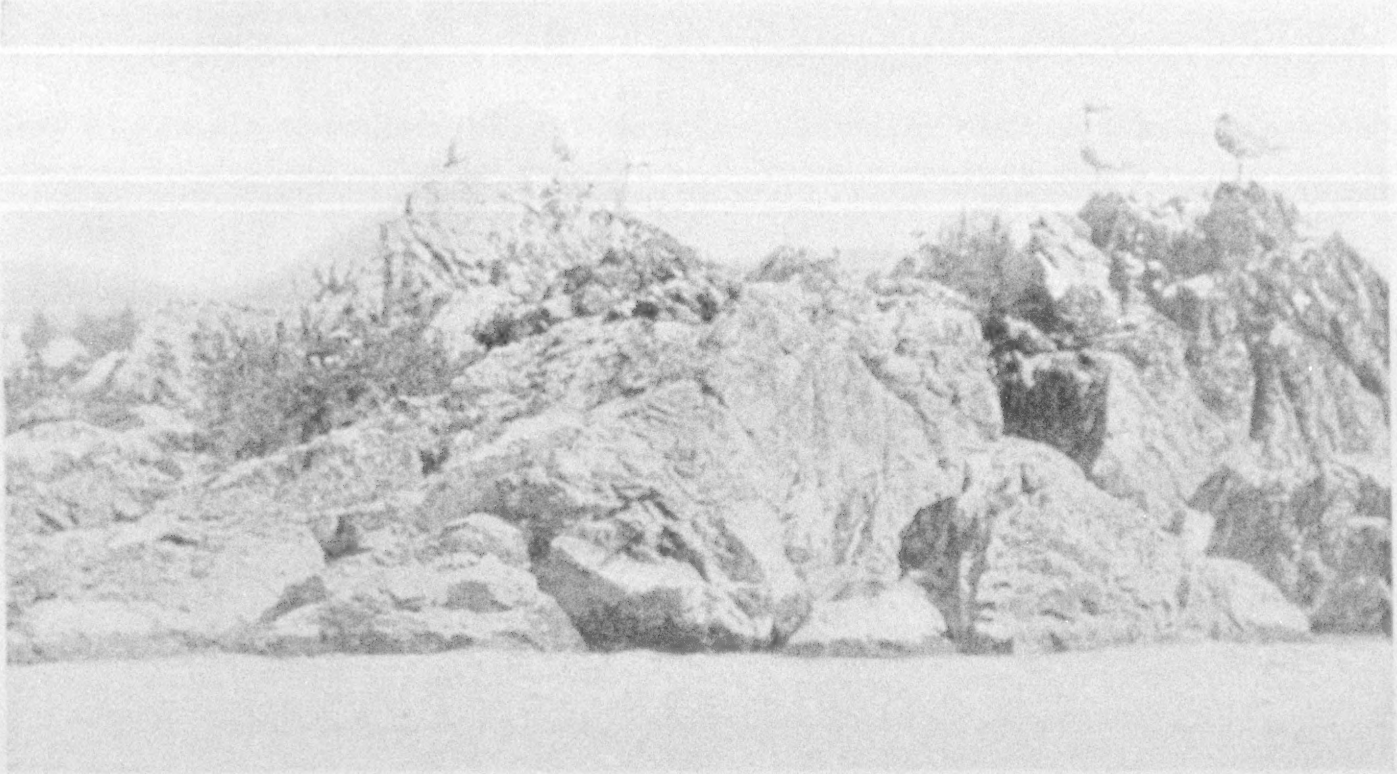


Photo by George Shiras, 3rd

COLONY OF GULLS ON ISLAND ADJOINING THE CORMORANTS

Here the protective coloration makes them difficult to be seen, whether on skyline or rocks. Contrast with the cormorants on page 438

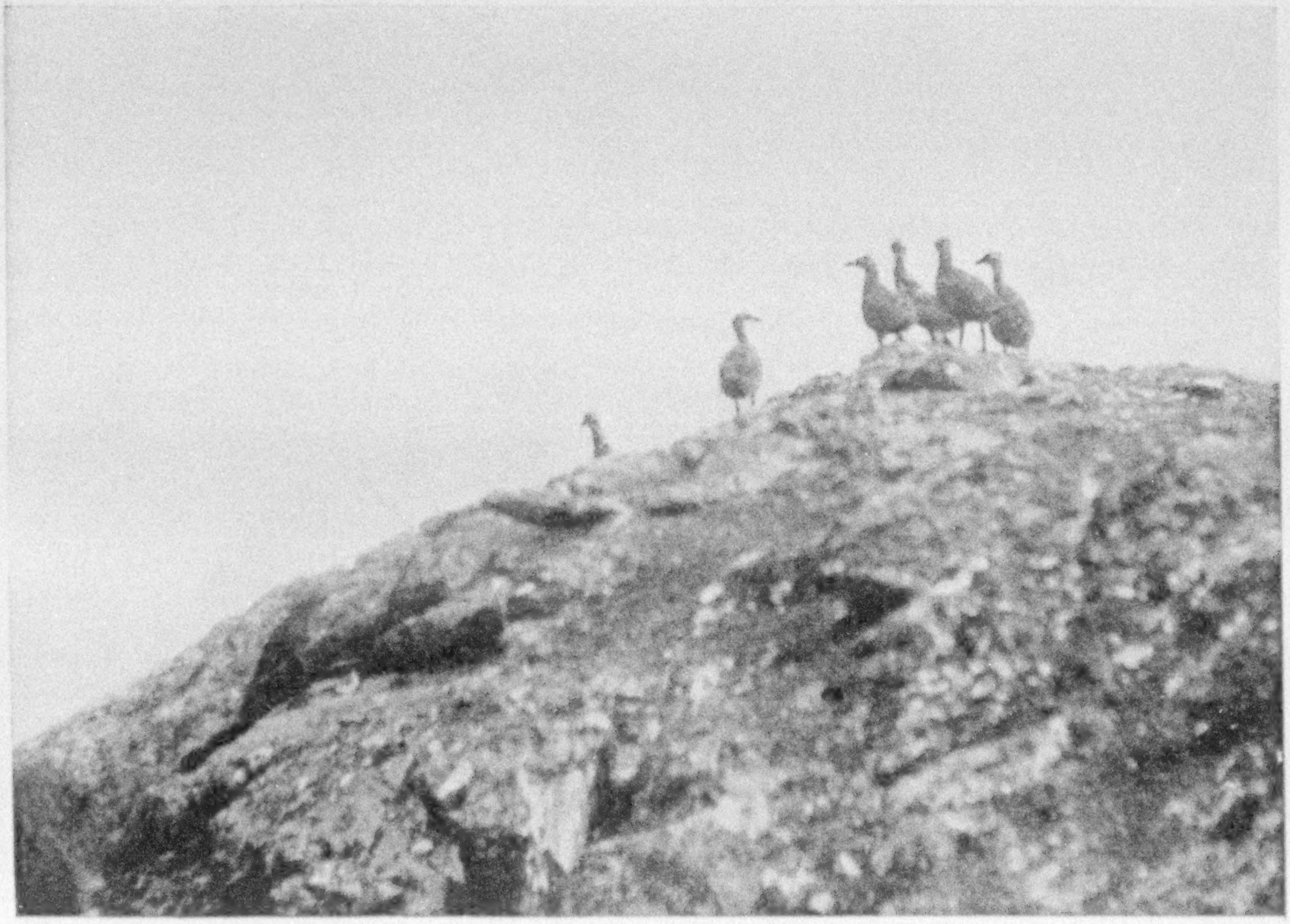


Photo by George Shiras, 3rd

GULLS

As it was impossible to photograph the gulls on the foreground shown in this picture, because of their protective coloration when crouched low, the author gradually compelled them to walk to the skyline. In this respect these young gulls possess an obliterative coloration quite in contrast to the young cormorants on the adjoining island.

Photo by George Shiras, 3rd

YOUNG GULLS WHOSE LATER COLORING HARMONIZED WITH THE ROCKS AND GRAY BRUSH SO CLOSELY THAT IT REQUIRED A SKYLINE PHOTOGRAPH TO SHOW THEM

See writer's opinion on protective coloration in first part of sheep article

the surface flow, for much of the ground was hard and dry, which accounted for the moose opening up a new lick near the lake by tapping the springs at the base of the sloping shore.

"The number of fresh tracks and the variation in size finally convinced Tom that a good many bulls were regular patrons. The surrounding country had all been burnt over many years before, and this was somewhat unfavorable for daylight photography, since bull moose are largely nocturnal, unlike the caribou and elk, especially when visiting licks or exposed feeding places. The ones we had just seen were early morning visitors, and the little patch of spruce would have sheltered them until afternoon or evening but for our unexpected arrival.

"While talking over the location of the blind in reference to the position of the sun at different hours and the probably prevailing winds—the two vital elements in this kind of photography—we saw the big bull a mile away, tearing along the top of a bare ridge leading to the mountain forests. His gait showed that stolidity had at last given way to a belated but overpowering fear. We never saw that animal again in the weeks spent on the lowlands. When cutting some brush a good-sized cow moose walked up within a stone's throw, trotting away unmolested.

"Anxious to know the number and course of the runways and the character of the country immediately back of the lake before taking up the daily vigil at the blind, we went inshore half a mile to the pond where the moose were seen the evening before. Here several acres of pond lilies in shallow waters were untouched—not a leaf or root had been eaten or disturbed—in striking contrast to the moose of Maine, New Brunswick, central Canada, and Minnesota, which always considered such aquatic plants the choicest of summer food. Yet I noticed the same lack of appreciation in the moose of higher altitudes in Wyoming and elsewhere. Going a mile further, Tom recognized a high mound as the lookout for the other lick, and this was examined with great care. While used to some extent, it was only a brief stopping place for the moose en route to the shore lick—indicated by the runways, but more particularly by the condition of the soil."

Whenever the wind was favorable and the weather clear I went to the blind, but usually between 9 and 4 the breeze came from the lake, cutting off the principal runways, so that in a few days a number of moose suspected, though unjustly, that a foe was in ambush near the lick.

Altogether I saw some 30 moose in the immediate neighborhood, many of them the same animals, returning on different days. One big moose came within easy rifle shot, got the scent and retired,

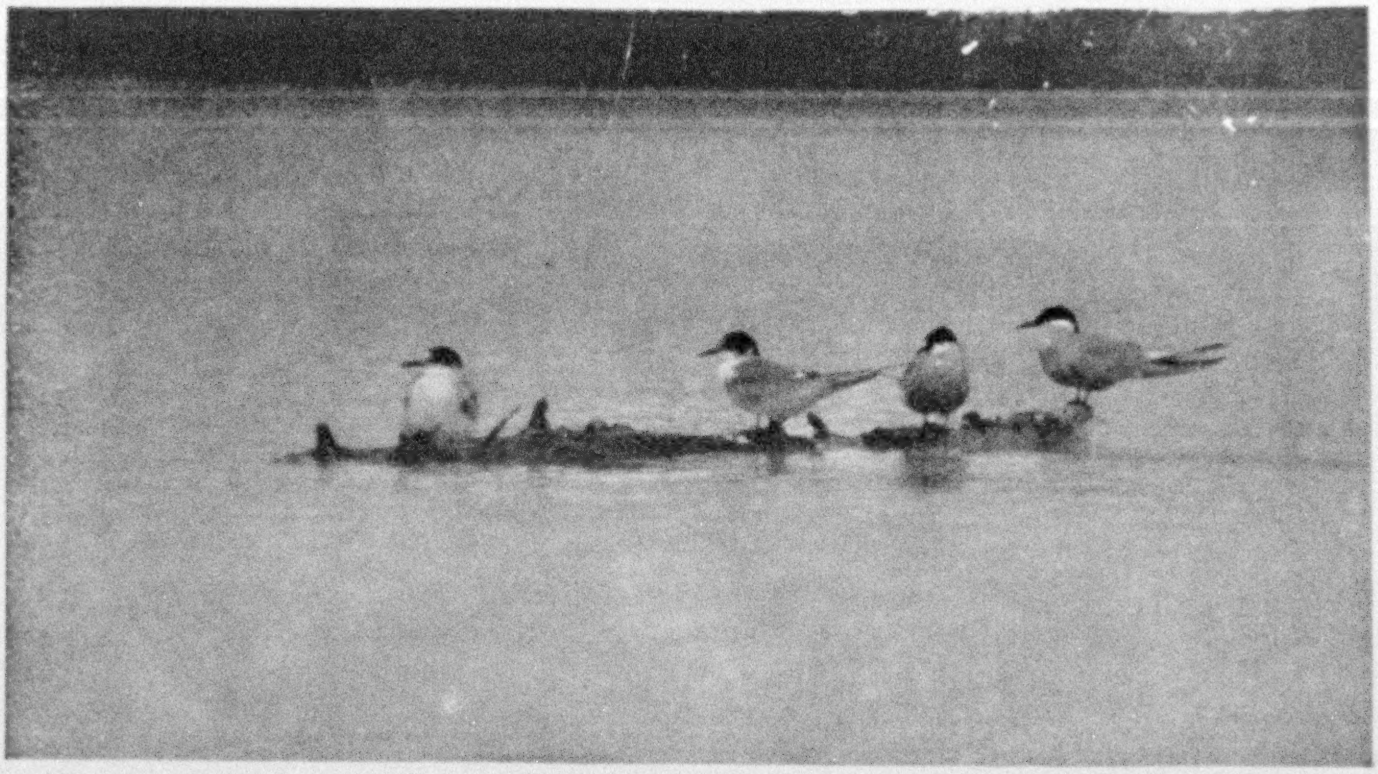


Photo by George Shiras, 3rd

ARCTIC TERN ENJOYING A RIDE ON A DEAD LIMB FLOATING IN THE CENTER OF SKILAK LAKE: THE BIRDS ARE LOATH TO LEAVE WHEN PHOTOGRAPHED AT SIX FEET

and two others, equally big, were at the lick one morning on arrival, but could not be photographed from the water. All the others, with one exception, were cows or bulls ranging from one to five years of age. The exception noted was an enormous bull that came down wind on an unused runway to the rear of the blind just when I was eating lunch. He gave a loud grunt behind my back and I nearly choked with surprise. In the excitement he got away, leaving only a mental picture of a frightened moose and a flustered photographer.

I saw no calves and only their tracks in some of the heavily forested valleys about the lake. Occasionally large moose could be seen a mile or two away feeding in and out of the willows near the summit of the mountains.

The light-brown color, noticeable the first day, was repeated in the case of all the other moose, the shade approaching very closely that of the great brown bear of the inland. Judging from the shreds of the spring-shed hair and that of several abandoned hides near hunting camps, the winter pelage must be a light buff-brown in color. In the extreme southern range most moose are dark-colored in summer, looking almost black at a distance, with a somewhat lighter shading on the legs and flanks.

Some of the pelts examined show that all the hair of the narrow abdominal strip was glossy black, while that of the side and back had buff-brown tips, with a pure white body to the root, so that, with the darker tips clipped, the animal would appear to be white from the ventral strip upwards.

The present classification of the giant moose depends chiefly upon skull characters and colors of the male, as shown by Mr. G. S. Miller, Jr., in the original description of the species, but it will doubtless prove that a careful examination of the pelage colors, superficial or otherwise, as in the case of *Ovis dalli* and *Ovis stonei*, will afford even better grounds than were originally supposed for recognizing the Alaska moose as a distinct form. The greater average size of the horns should also form a distinct character.

Several encounters with regular patrons permitted observations somewhat out of the ordinary and may be quoted in part:

Photo by George Shiras, 3rd

VIEW OF SKILAK LAKE FROM OUR CAMP (SEE PAGE 439)

A COW MOOSE THAT BECAME SELF-EDUCATED

“Caribou Island Camp,
“August 17—Ther., 74-38.

“Just before noon the wind veered to the south, coming well offshore. Charlie paddled me across the bay to the blind and then went after a mess of partridges.

“I was hardly in ambush before the old cow moose was at a mud hole opposite, drinking a gallon or two of the muddy mixture. So active was the effect upon the salivary glands that long strings of saliva drooled to the ground (see also pages 443 and 448).

“Determined to try for a close picture and to test her disposition when thus interrupted, I boldly walked in view, crossing the bare and much-trampled field to within 50 feet. She stood broadside, head up, and unquestionably looking at me out of one eye, but to all appearances utterly indifferent to my approach (see page 451). Taking a picture, I went a little closer, when she turned away without looking, and again the camera recorded the scene.

“While changing plate-holders, I was surprised to see the moose turn about and come toward me on a slow trot. To the uninitiated this would probably have meant a bold charge, and to the nature faker sufficient grounds for an exciting story. The animal was now so close that I could notice the nostrils working convulsively, and could see that if let alone she would pass to my leeward about five feet—the first position in which she could get the scent without coming at me directly (see page 453).

“Wishing to avoid alarming her so soon, I backed across the field to the edge of the marsh, but she still followed. Turning my back to the animal, I walked ahead, and upon reaching a place where the ground was almost impassable with fallen timber, I stopped. By this time I noticed that she had crossed my tracks, and thinking perhaps I was mistaken about her wishing to get the scent I awaited developments. The cow immediately came up, circled almost within reach, and then was struck by the scent.

“The effect was instantaneous and remarkable. Sinking back on her haunches, I noticed that the shoulders trembled violently, just as though a rifle ball had penetrated her through and through, and then, with a quick awkward plunge, she made off at her fastest gait. And thus this innocent and impassive animal suddenly revealed its inherited dread of human scent.”

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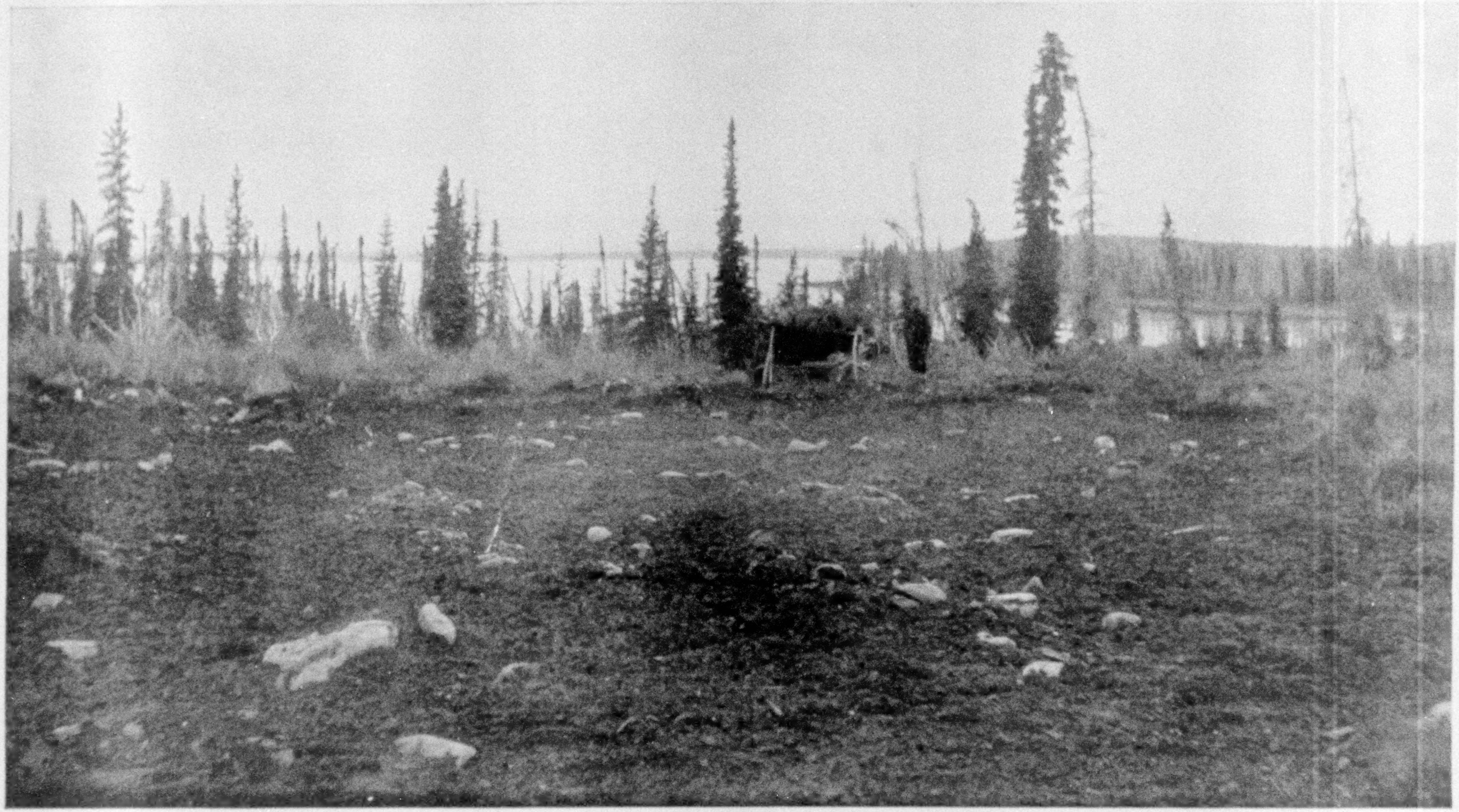

Photo by George Shiras, 3rd

THE MOOSE LICK OF SKILAK LAKE (SEE PAGES 441 AND 443)

The impregnated soil has been eaten several feet below the surrounding marsh, exposing rocks and uncovering many small mineral springs. The view shows the lower half of the lick, looking toward and across the western end of the lake. The water brought back by the author shows the following analysis: "When the container was opened and air came in contact with the water, the clear water became, after some hours, opalescent, as if sulphur had separated out. Qualitative analysis showed in the water: sodium, strong; chlorine, strong; iron, marked; aluminum, marked; calcium, decided; magnesium, certain; sulphuric acid, present; phosphoric acid, present; sulphides, present. Quantitative analysis of clear water gave 175 grains of total solids present in one U. S. gallon of water. From the determination of chlorine and calculation of this as sodium chloride, there was found 113.9 grains of common salt to one U. S. gallon of the water. The taste of the water was strongly salt, with a bitterish after-taste. In its behavior on evaporation it resembled the saline waters of Ohio. It is positively a saline water and not an alkaline water."—Analysis by Dr. Charles E. Munroe.

A LITTLE BULL MOOSE THAT WAS FORCIBLY EDUCATED

A few days later there occurred another scene in the same locality and with a somewhat amusing sequel:

"*August 27—Ther., 58-34.*

"One of my favorite visitors was a little bull moose. At first he always came in company with a five-year-old, but the latter got too much scent once and ran off, with the smaller one trailing wonderingly behind. On this occasion he was alone. The way he kept eyeing the blind rather indicated that a visit had been made there during my absence.

"Today he came from the long point, where the flies were scarce, and after filling up nearly to the bursting point, laid down in the middle of the lick for a nap. As this was to be the next to my last day in the blind, I concluded to try some more experiments. Coming out of the blind, he saw me at once, but did not get up—simply turning his ears my way and expressing great astonishment in his big, round eyes.

"When I got very close he arose and walked to the edge of the marsh, when, getting the sun behind me, I took his picture (see pages 455-458). And later I tried to force him down toward the lake in order to get a more effective background. This he objected to, but ran about playfully, showing no concern whatever over the scent.

"After taking a few more pictures, I concluded that I would be doing a very poor service to leave him in this unsophisticated state of mind. It was plain he now no longer feared the sight or scent of man, and would doubtless soon fall a victim to a party of hunters camping half a mile down the shore.

"Selecting a good-sized club, I got as close as possible, partly accomplished by grunting like a bull.

"Throwing the missile with all my force at his well-covered ribs, I gave a piercing yell at the same time. The marksmanship was poor, for the stick struck the ground just this side and one end flying up hit him in the pit of the stomach. This probably had greater effect than a drubbing on the ribs—however much it violated the ethics of striking below the belt—for he jumped up into the air with his back arched like a scared cat. When he came down there was no doubt about his intention or ability to get out of that part of the country. Before I could pick up the camera he had vaulted over and beyond the fallen timber."

Only once, when I blew up a huge grizzly bear with a flashlight machine, have I known an animal that got its education quicker, and never, as later events proved, to better purpose.

The following day I came to the blind at an early hour, hopeful that one of the big bulls from the hills would come within photographic range. Just what occurred becomes a necessary part of the diary entry of the previous day.

"*August 28—Ther., 72-38.*

. . . "From the start the wind was variable and so light that the mosquitoes became annoying for the first time. Twice I saw a cow moose wandering about, but she was wary. As the hours passed I was satisfied that the little bull had made his valedictory appearance and was not disappointed by the thought.

"Precisely at 2 I heard the sound of a heavy animal running, then a splash down toward the lake, where I could see the little bull struggling out of a mud hole, his feet working like the blades of a water-wheel, and then out he got, rushing on without a stop or a glance to the rear. Evidently something was after him—possibly a grizzly bear that looked now almost as big as a locomotive.

"Getting out the field glass I covered what was likely his back track for a long distance, finally noticing the figures of two men coming down a hillside, and as each was armed with a rifle I knew they were not my guides. On their approach I arose, and after a greeting found that the larger and heavier of the two was Jim Jeffries, the ex-heavyweight champion of the world. He explained in substance that they were out after a supply of fresh and tender meat, preparatory to hunting big bulls for their heads: that

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they had seen in a dense cover the flanks of a small moose, and to make sure it was not a cow, the killing of which was prohibited by law, they crept up very close, when, making a slight noise to bring the head in view, the animal gave a quick glance out of the corner of one eye and then put down the hill as though the devil was after him. Not till he was beyond favorable rifle shot did the glass disclose the small horns. They were now pursuing it in hopes of a shot. The man of muscle trusted that they had not interfered with my getting a photograph of the little bull. Assuming a slight disappointment, I indicated that it was fully overcome by the opportunity thus presented of getting a photograph of a *homo gigas* and snapped him instanter."

That this latter picture does not appear herewith is due to the conservative attitude of the Editor, who "was uncertain whether some of the readers of this Magazine would stand for that kind of wild game." Hence the omission.

A month later I heard that the little bull had apparently gone through the hunting season unscathed. This year he is proudly growing a pair of Y-shaped horns, and who knows but what in the course of time he will be seen stalking across the ruddy tundra or standing like a sentinel on a granite ridge wearing a polished and serrated crown, so remarkable in size and symmetry that the *Alce gigas* of the Kenai shall have in him that type which will represent in the future as in the past the largest of the antlered race since the days of the prehistoric Irish elk.

A NEW SPORT FOR OLD SPORTSMEN: HUNTING FOR SHED ANTLERS

When a sportsman visits the distant wilderness and shoots a big bull elk, moose, or caribou, especially in the rutting season, when they are most easily found and killed, it is seldom that any of the rank flesh is used at all, and the horns afford the only trophy, while the great carcass, weighing from 400 to 1,200 pounds, according to the species, is left for the ravens and the coyotes to feed upon. And even though such big beasts are killed at a time when the meat is untainted, its toughness or the great distance from civilization prevents much of it being used.

On one of my photographic hunting trips to Newfoundland, I met, far in the interior, three Eastern sportsmen who had just killed nine big caribou stags, the three apiece allowed by law. Only the heads were removed, for the 3,500 pounds of meat was then unfit for food. As fully 100 non-resident sportsmen were there on the island, the abandoned carcasses might better be estimated in tons than pounds. With the smaller varieties of deer, killed usually in the neighborhood of settlements and generally free from a seasonal taint, such wastefulness seldom occurs.

To a sportsman controlled by the most ordinary sense of propriety, it must necessarily follow that after getting a fine head or two of the larger game, he ought then to discontinue their pursuit with a deadly weapon. To one who uses from the start, or later supplants the rifle with the camera, there exists every corresponding incentive in this more harmless method and a much better opportunity of studying the life of wild animals.

Yet it is easy to see how there may be those who desire, in addition to pictures or lantern slides, some more tangible evidence of their visit to the remote homes of our antlered monarchs, and this is to suggest a way of getting such trophies without shedding blood or wasting mountains of flesh.

Between November 1 and March 1 the larger bull caribou, moose, and elk shed their horns, and in the order given. Unlike the white-tail deer, which usually drop their antlers each fall in the dense coniferous forests and swamps, where porcupines, rabbits, red squirrels, and mice soon destroy or disfigure the same, the caribou, when feeding in the winter time on the moss of the wind-swept barrens, the elk upon the dry grass in the open parks and rolling hillsides, and the more northerly moose upon the bark in the willow thickets or second-growth hardwood forests, usually cast their antlers in places harboring few if any form

Photo by George Shiras, 3rd

THE LARGE COW MOOSE THAT EDUCATED HERSELF (SEE PAGE 447)

She stood broadside, head up, and unquestionably looking at me out of one eye, but to all appearances utterly indifferent to my approach

of rodent life, and hence in such localities one may find many horns and most of them in perfect condition.

Such as have become bleached from long exposure can be stained to their natural color, and, when mounted on a wooden base the fac-simile of a frontal bone, resemble in all respects those of a freshly killed animal. While it has long been the custom in this country to mount the head and neck, in time the shrinking skin, the twisted ears, and the ravages of the moths greatly impair the work of the ordinary taxidermist, so that the old English method of simply using the horns and part of the skull has much to recommend it; for such ancient specimens after untold centuries are often superior to those in this country after a lapse of a few years.

Of course, in the mounting of shed antlers, only the largest and most symmetrical should be used, in contrast to the habit of mounting many inferior heads; but a great deal of pleasure can be had and much information obtained by collecting in the wilderness all sizes and shapes of horns, and it is immaterial that in many cases only a single antler can be found.

During explorations covering three seasons in the Rocky Mountains, I discovered along the upper Yellowstone River, partly in the park and partly in Wyoming, a very large number of moose occupying a valley four miles wide and thirty miles long, at an elevation of 8,000 feet, where, isolated in the wildest and least frequented portion of the country, they had thrived unknown to the public. My notes and photographs, covering observations of more than 500 moose and in a country where they were then supposed to be practically extinct, was most

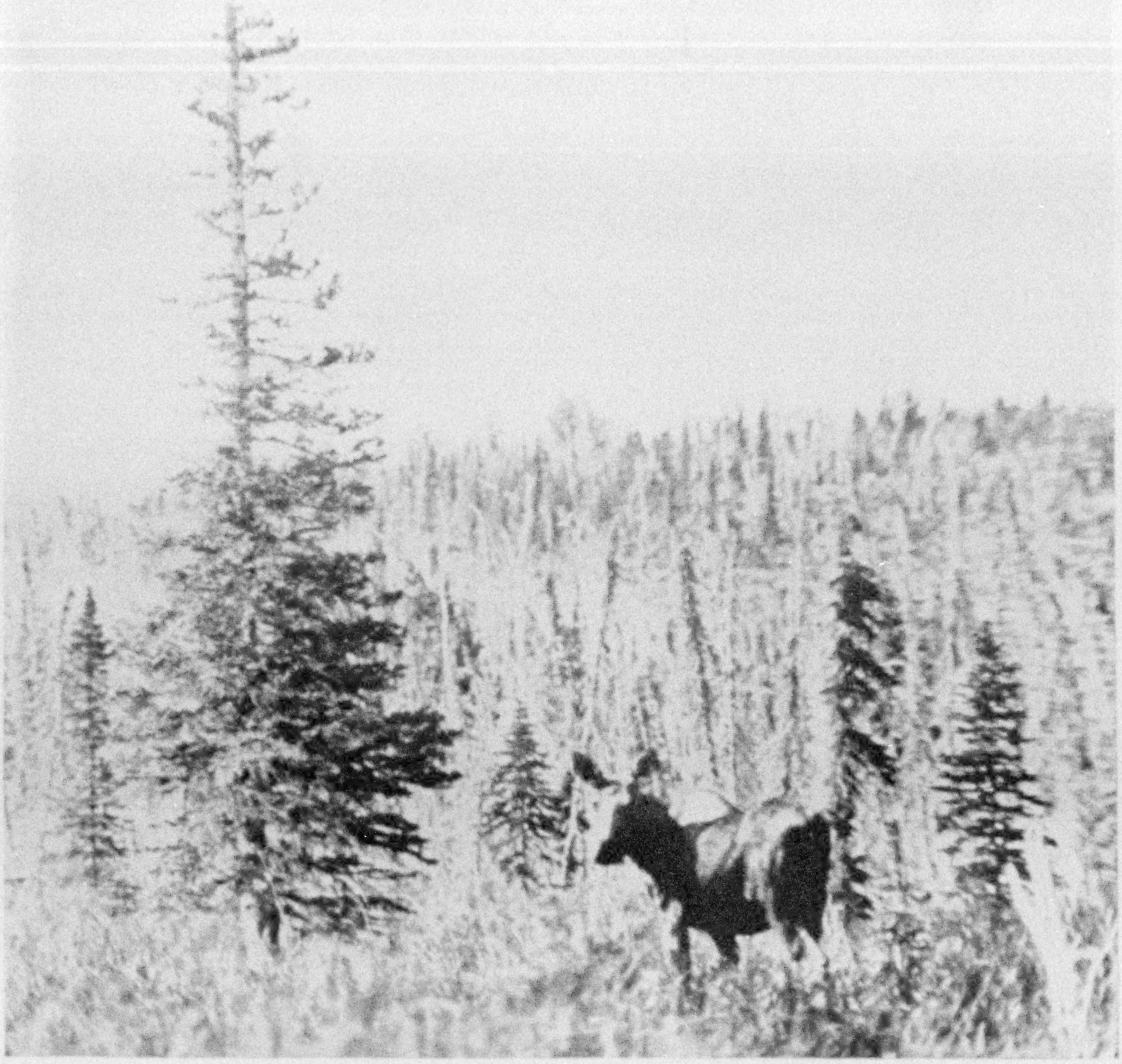

Photo by George Shiras, 3rd

ANOTHER VIEW OF THE COW MOOSE THAT EDUCATED HERSELF

"I went a little closer, when she turned toward me, and again the camera recorded the scene" (see page 447)

impressively corroborated by the fine collection of moose horns, found along the river bottom in willow thickets, where the absence of pine forests and the annual overflow each contributed to the scarcity of rodent life. These horns were later presented to the Biological Survey and constitute its only collection of the mountain type of this animal.

During the several weeks spent in studying and photographing moose near Skilak Lake, the network of runways throughout the poplar and birch thickets showed very plainly that this was one of the great winter feeding ranges of these animals, and that a systematic search would doubtless reveal many fine antlers. In this we were successful from the start, and nearly every afternoon, on taking the canoe for camp, one or two big or oddly shaped horns were a part of our cargo. And if the camera failed in its quest on such occasions, here were the discarded crowns of the giant moose, many of them worthy of portraiture and many of permanent preservation.

By carefully noting the course of our rambles, in less than a week a square mile was pretty well covered and brought to view 26 nearly perfect antlers, aside

Photo by George Shiras, 3rd

THE SAME COW MOOSE COMING TOWARD THE AUTHOR

"While changing plate-holders, I was surprised to see the moose turn about and come toward me on a slow trot. To the uninitiated this would probably have meant a bold charge, and, to the nature-faker, sufficient grounds for an exciting story. The animal was now so close that I could notice the nostrils working convulsively, and could see that if let alone she would pass to my leeward about five feet—the first position in which she could get the scent without coming at me directly" (see page 447).

from nearly an equal number found in the bordering spruce forests, which the porcupines had, with few exceptions, badly gnawed (see pages 460-461).

The members of two hunting parties who visited our camp were surprised and pleased at this collection, and could not understand why they had only seen a few worthless horns in their long journeys afoot. This was because the more open country was usually watched from a knoll with the aid of field-glasses, or they failed, when moving about, to detect the prong or two of some great horn nearly hidden in the soft moss, or did not know the meaning of the great white slabs here and there on many an exposed hillside. In one case I located the best antler of the trip at the distance of over a mile, the glass showing that the serrated edges could not be other than the outer rim of a fine horn.

Three distinct types of horns were found: First, the so-called normal, or broadly palmated kind; second, one of great length and narrow beam, and third, a small fan-shaped variety (see picture, page 465).

The first type was represented at times by two rather unusual modifications: (*a*) great thickness of the lower beams with a second set of brow antlers beneath, and (*b*) broadly palmated horns with no divisional separation of the so-called brow antlers (see page 464).

In no other range of the moose have I found such a variety except in the highest mountain valleys of the Rockies, and it suggests the conclusion that the northern latitudes affect and vary the

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horn growth as do the higher altitudes further south.

The writer earnestly contends that it is a false pride which always leads a sportsman to pass by a beautiful antler and a false standard which always requires their removal from the head of a personally slaughtered animal. To the public, for the use of museums and in the comparison and differentiation of the various types of horns, shed antlers are just as valuable and just as interesting as many having a narrative of blood and wastefulness in their taking.

Photographing wild animals requires all the skill and endurance demanded by the most ardent and experienced sportsman, and the finding of the discarded antlers of a giant moose adds a zest to the photographic hunt and a valuable trophy for the trip, and surely not less sportsmanlike because its former owner is still permitted to roam the wilderness as the largest antlered animal of modern times.

Fortunately for this branch of sport, it requires patience, persistence, a fair knowledge of the animal's habits and range, and when the best horns only are selected the collection will represent quite as much skill and value as when secured by killing the unfortunate owner thereof.

THE ALASKA PTARMIGAN AND HOW CLEVERLY THEY PROTECT THEIR YOUNG

To the mountain climber of the northland there are no birds more interesting than the ptarmigan. One species, the willow grouse, or willow ptarmigan, occupies the thickets bordering the tree limits, and a hardier and more humbly plumed kind, the rock ptarmigan, lives on the rocky slopes and snow-clad summits of the higher ranges. This interest is largely due to the ease of observation, for the birds are tame and numerous, and again because they can be counted upon to supply the larder with a portable and well-flavored article of food.

For several weeks we were in the midst of these birds, and when making daily rounds to the grassy plateaux, where the sheep were apt to be found, I spent a good deal of time following up the smaller streams in order to study and photograph the birds in their natural surroundings.

Familiar with many other species of grouse, I was particularly impressed by one characteristic of the cock willow ptarmigan, which differed so from the conduct of male grouse of the forest and prairie, in that he almost invariably remained with or accompanied the female during the entire breeding season and, moreover, was the most aggressive parent of the two in times of peril.

One's proximity to the family was usually foretold by the sudden fluttering out of the cock, which, with a limp and trailing wing, employed the usual devices of most ground-breeding birds in the effort to coax in futile pursuit any known or suspected enemy, and then, if successful in leading such away from the spot where the young crouched by the side of their silent mother, the cock would take wing, uttering loud and raucous notes, finding concealment in a near-by thicket.

But if one persisted in trying to locate the young, then the female would renew the effort to distract attention, and if this did not succeed she would utter a peculiar note signaling the male to return, and then between the two of them some plan would be devised to prevent the discovery or injury of the young birds.

In a hundred or more observations the cock was apparently absent only half dozen times, which might be accounted for by his untimely death in defense of his family or by a temporary absence in search of a particular kind of food.

Two instances of this strategic cooperation of the parents may be quoted from my notebook:

"*August 9.*

"Following the creek bottom for nearly a mile, we found the ptarmigan unusually abundant, for the day was warm and quiet and the birds were sunning themselves on the gravel bars or dusting their feathers in basins hollowed out in the sloping banks. One brilliantly colored cock rushed out at us from a patch of dried grass and I followed him down the stream a few rods with the

Photo by George Shiras, 3rd

THE YOUNG BULL MOOSE THAT WAS FORCIBLY EDUCATED (SEE PAGES 449-450)

camera, but his gait increased until he took wing, so I returned to the spot where the rest of the family were doubtless concealed and could faintly see the hen outlined in the thin grass, while the five or six young, almost at my feet, were not noticed until the old bird took flight, when they, too, popped up into the air, and with their short wings managed to fly out of the creek bottom and tumble into a willow thicket a few yards away.

"Going to the lower end I had one of the guides walk through the willows, but before the family were driven out the cock returned in response to the call of the hen, and I finally got a picture of him standing boldly on a rock in the middle of the stream. The parents then led the young into a blue bed of flowering peas, and when the two returned to guard the retreat I got a portrait of the pair" (see pictures, page 466).

Again, under date of August 27:

"While sitting in the spruce blind waiting for moose, I noticed a large hawk circling the marsh in search of prey. As it passed behind me there was a roar of wings, and turning I saw a brood of willow grouse in the air with the hawk poised above, apparently uncertain which victim to swoop down upon, but before this was determined the cock shot up straight as an arrow in front of the hawk and then the race was on. For the first 50 yards the two were separated by only a few feet, but the way the cock suddenly increased its speed showed very plainly that flight was under check until the hawk was lured away far enough to give the surprised family a chance to find some sort of concealment.

"In a minute or so the hawk returned and carefully circled over the hummocks of moss, looking intently for the slightest trace of one of the covey. Down it suddenly dropped for a distance of 20 feet—undoubtedly seeing the brown feathers of a partly concealed bird—but with equal speed the hen darted up, apparently hitting the body of the hawk just below the tail, and either because the talons could not clutch it in such a position or because unable to strike with

Photo by George Shiras, 3rd

ANOTHER VIEW OF THE YOUNG BULL MOOSE WHO WAS FORCIBLY EDUCATED (SEE PAGES 449 AND 450)

accuracy, the daring mother escaped with the hawk in fierce pursuit. Here, again, the slow speed enticed the hawk some 50 yards away, when the hen dropped like a plummet into a bunch of alders, while the hawk seated himself on a near-by limb to plan anew his breakfast.

"But the defeated aviator knew very well that two from eight left a substantial balance, however deficient the mathematical process, and once more he returned for a survey of the tangled moss. This time he was met by a shout and a waiving hat from the spruce blind, and, much disgruntled, soared away, doubtless wondering at the intervention of a third party, a wonderment that would have been still greater had it known the deadly relation between man and every bird and every animal possessing toothsome qualities, or whose plumes, pelage, or antlers had a monetary or trophy value."

In such efforts to save the young it was clear that the parent birds possessed the same bravery and the same cunning methods in misleading an aërial enemy that they did a terrestrial one.

In the Kenai Peninsula the timber line is about 2,000 feet, and only twice were willow ptarmigan noticed below it, where they were feeding in an open glade upon the earlier growth of swamp huckleberries. The usual abodes of this bird are the tablelands along upland streams terminating in ravines, where the willows and small bushes succeed the limit of arboreal growth. The rock ptarmigan either stays at the very crest of the mountains or on the sloping sides, where the lichens and patches of grass denote the limit of all vegetation. On the other hand the spruce partridge remains well within the forested area and is usually to be found in river bottoms or in the second-growth, burnt-over portions of the lowlands (see pages 467 and 469).

Thus these three species of Northern grouse, while occupying adjoining ground, are largely if not wholly controlled by the distribution of plant life rather than that of any given altitude.

One afternoon I saw a small and apparently young red fox coming rapidly

Photo by George Shiras, 3rd

THE SAME BULL MOOSE

"After taking a few more pictures, I concluded that I would be doing a very poor service to leave him in this unsophisticated state of mind. It was plain he now no longer feared the sight or scent of man, and would doubtless soon fall a victim to a party of hunters camping half a mile down the shore" (see page 449).

down a rock slide, evidently trailing but not seeing his quarry. With a field-glass I could make out a brood of rock ptarmigan scurrying ahead. When the birds reached the bank of a small ravine, filled nearly to the surface with snow, the hen flew up about ten feet, alighting on the snow, and the little ones with an effort did likewise; and, thus concealed from the immediate vision of the fox, they ran a short distance and squatted, resembling very much the detached rocks and soil dotting the edges of the snow.

When the fox reached the bank he looked intently about and, seeing nothing, descended, sniffing along the surface of the snow below where the birds alighted. Evidently thinking that they had flown across or gone further down, he climbed up the opposite bank. Here a large fat marmot, extracting a root only a short distance away, attracted his attention, and although they were about the same size, the sudden flight of the latter induced pursuit, which ended unsuccessfully a few yards away, at the opening of the burrow.

So little time was spent on the mountain summits that I had small chance to observe the habits of the rock ptarmigan. In no case did the cock accompany the brood, and it seemed as though these birds had no fear whatever of the larger forms of animal life. The hen had two warning notes for the young, one causing them to remain stock still or crouch wherever they happened to be—and so faithful was the obedience that I could pick the young up—and another note, which caused the young to immediately seek an overhead protection, either beneath the broken rocks or under the rims of snow or ice.

Once I saw seven small ptarmigan run beneath the edge of a block of ice, and all I could see was the projecting row of small black bills; and in another case the young bird, alarmed by the mother's note, squeezed in between my shoes and remained there until relieved by a reassuring call. Hawks and foxes are the principal enemies, while moose, caribou, sheep, or man seem to be regarded in the light of friends.

THE ALASKA SALMON AND THE TRAGEDY OF THE SPAWNING GROUNDS

Many know that the salmon industry

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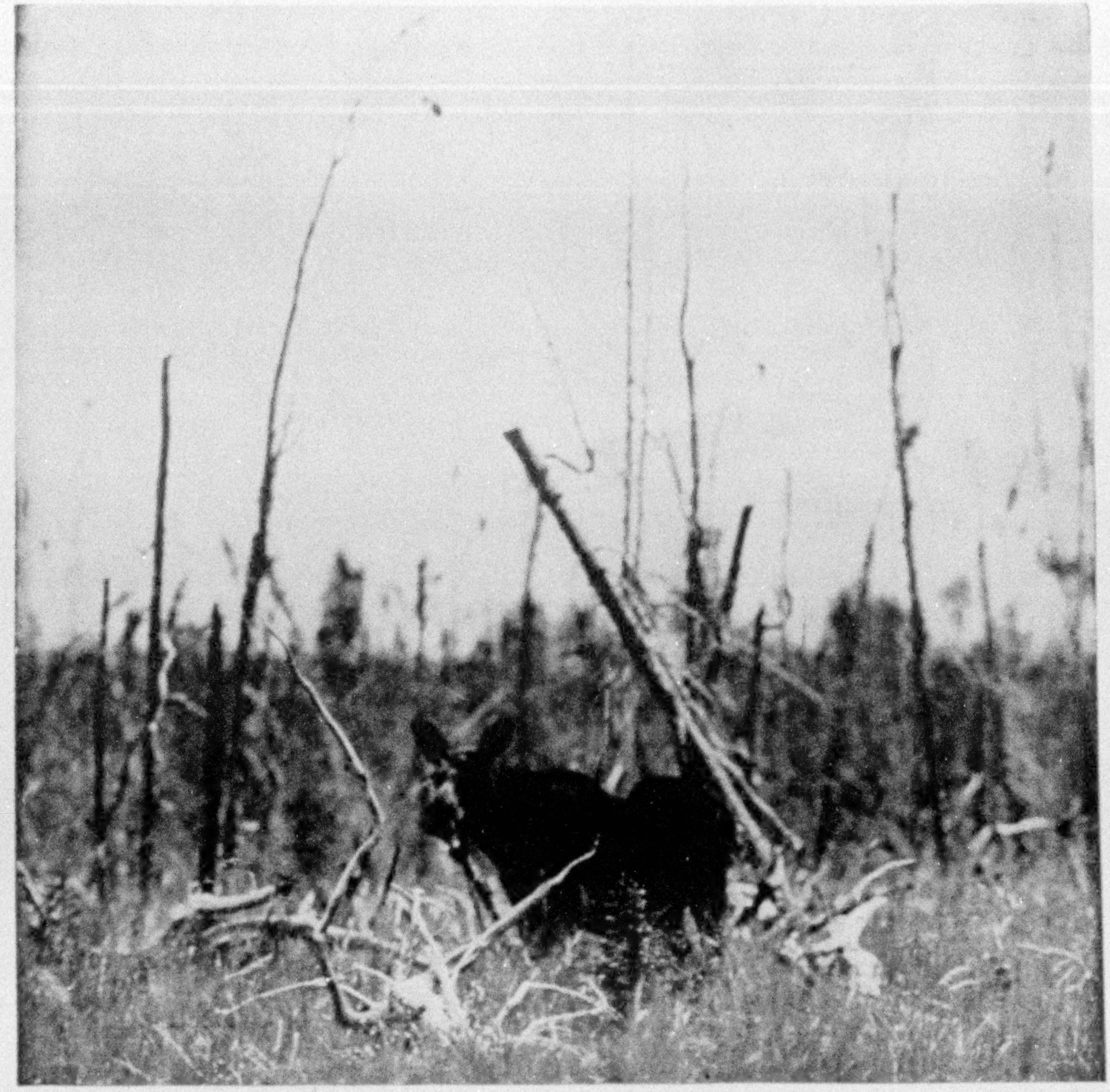

Photo by George Shiras, 3rd

"Throwing the missile with all my force at his well-covered ribs, I gave a piercing yell at the same time. The marksmanship was poor, for the stick struck the ground just this side and, one end flying up, hit him in the pit of the stomach. This probably had greater effect than a drubbing on the ribs, however much it violated the ethics of striking below the belt, for he jumped up into the air with his back arched like a scared cat. Only once, when I blew up a huge grizzly bear with a flashlight machine, have I known an animal that got its education quicker, and never, as later events proved, to better purpose" (see page 449).

of Alaska is one of its best and certainly its most reliable producer of wealth, but few in the eastern portion of our country realize that, unlike the Atlantic species, the salmon of the northwest coast, male and female, always die following the spawning season in the fresh waters of the interior.

Of course this means that the salmon, of which there are five species, spawn but once, on reaching maturity, and therefore their perpetuation depends upon a reasonable protection for the brooding fish.

From the middle of July into October the swift rivers are carrying towards the sea millions of dead and dying fish. As practically all of these lodge on sandbars or sink to the bottom of the ice-chilled streams, the air becomes polluted and the waters defiled to such a degree that a good many who witness these repulsive scenes acquire an unconquerable distaste for salmon thereafter, be they fresh or

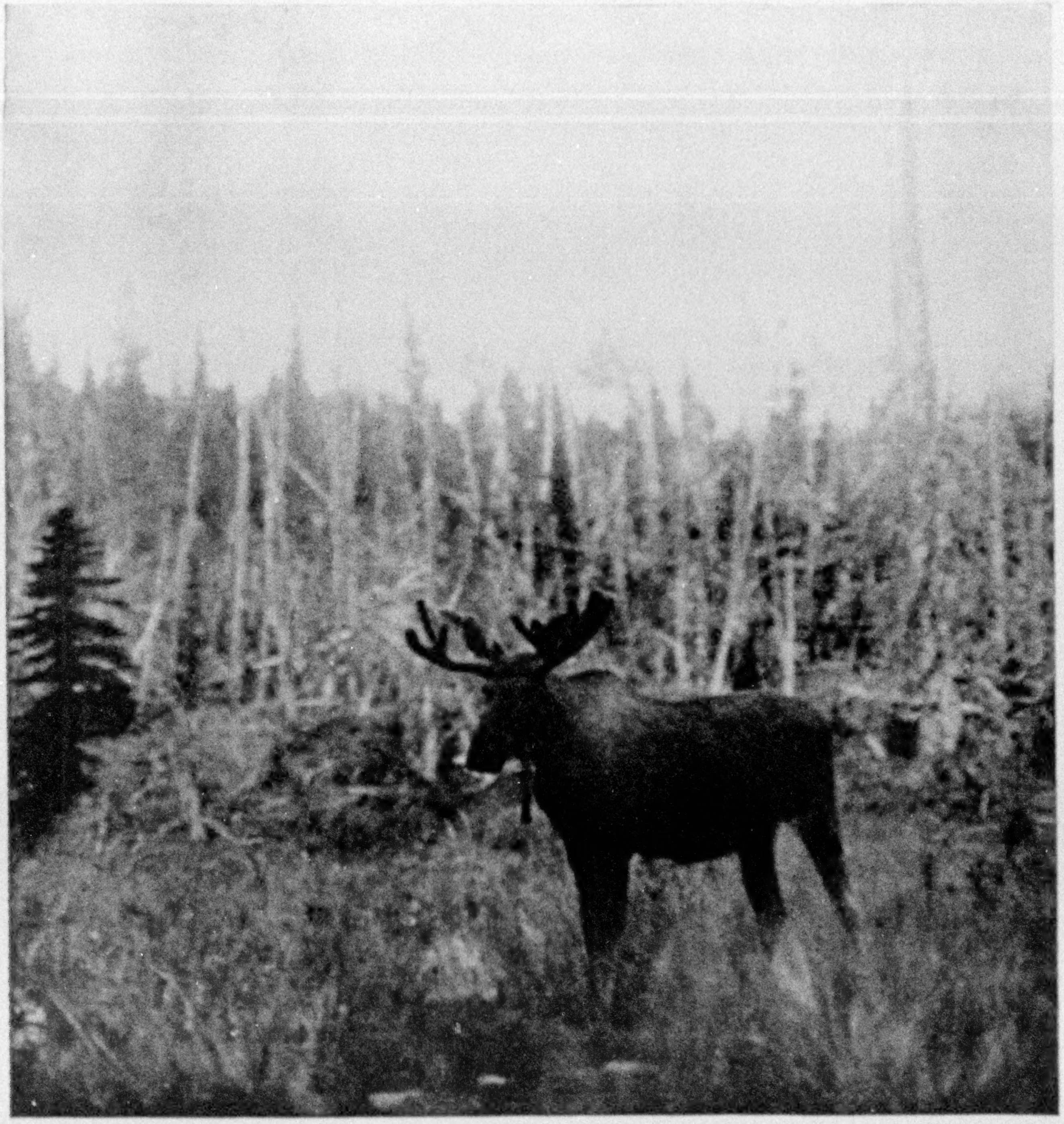

Photo by George Shiras, 3rd

A FAIR-SIZED BULL AT EDGE OF LICK

Note the long, remarkable "bell," which dangled for 18 inches from its neck and looked exactly like a broken halter end, swinging freely as the animal walked

canned. This should excite no prejudice elsewhere, since all the fish for commercial purposes are taken before or shortly after entering the fresh-water rivers, when they are in fine condition.

Comment has been made upon the mutilated bodies of the stranded fish, and many seem to think that this was entirely due to battling upstream amid jagged rocks, whirlpools, and rapids. The writer saw no indication of this, but did find there existed a strange and fierce enmity between the fish, under conditions now described, which surpassed any contest between kindred species that he had ever witnessed.

This impulse to seek the uppermost waters of a particular stream, be it a mile or a thousand miles in length, apparently continues after the spawning period, and so each salmon, weakened from spawning and the refusal or inability to eat on leaving salt water, still instinctively struggles against the swift waters, gradually drifting back, tail first, until a pool behind a log-jamb, the entrance to a slough, or the slower waters of a side channel afford a temporary

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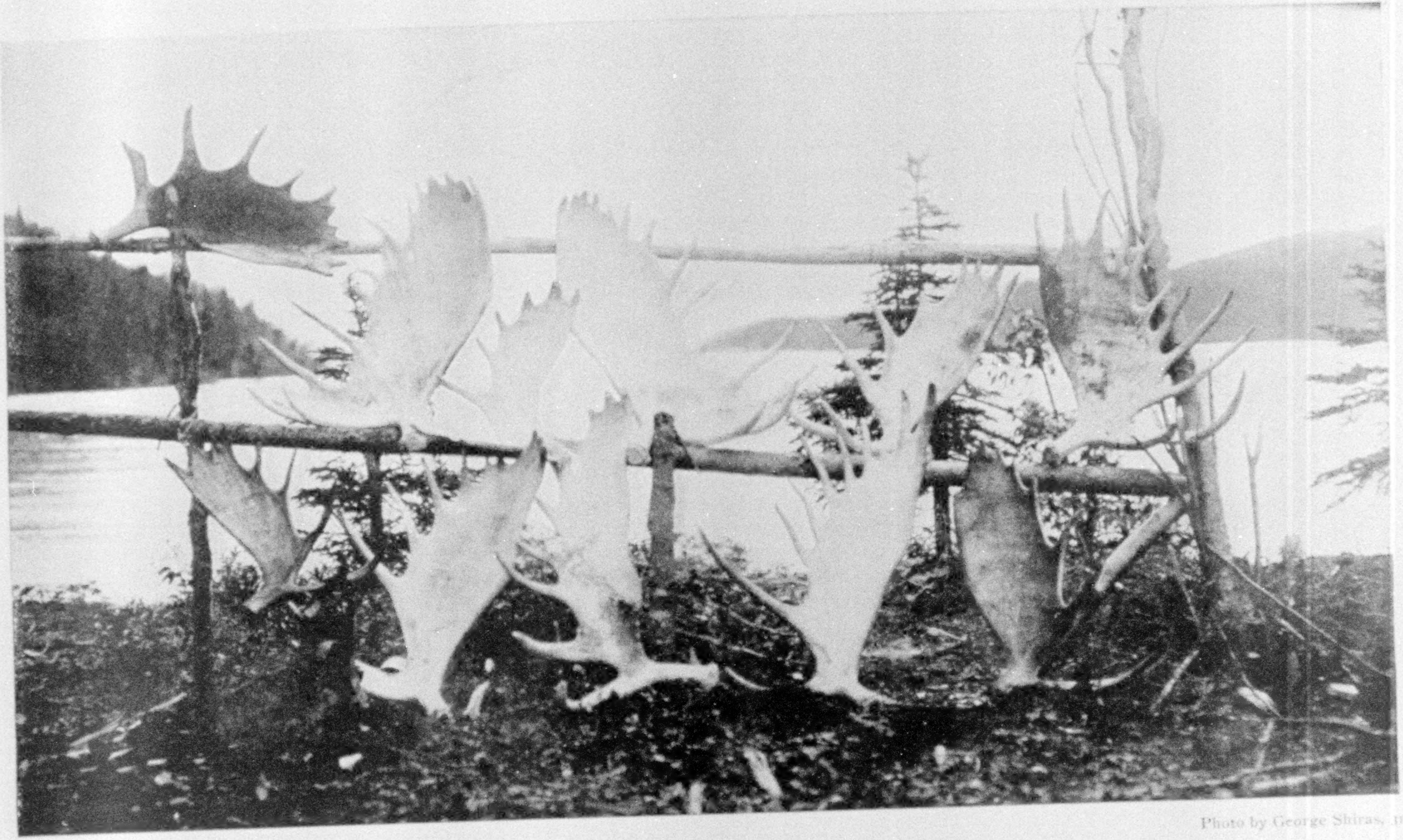

Photo by George Shiras, 3rd

A NEW SPORT FOR OLD SPORTSMEN: SOME OF THE FINEST MOOSE HORNS FOUND DURING THE TEN DAYS AT DOUBLE-BAY CAMP, THE COLLECTION BEING ADDED TO LATER (SEE PAGES 450-454)

Photo by George Shiras, 3rd

A NEW SPORT FOR OLD SPORTSMEN: A BOAT LOAD OF ANTLERS GATHERED ON THE OPEN MARSHES ON A SINGLE AFTERNOON (SEE PAGES 450-454)

harbor, and here they collect by hundreds before making another effort to ascend the stream, only to be carried further down each time, until the death paroxysm seizes each, when, after a few mad dashes with the head out of water gasping for air, they die with surprising suddenness.

The salmon most abundant in the interior streams of northwestern Alaska is the sockeye, or red salmon.

Investigations by the Bureau of Fisheries have shown that "this species is peculiar in that it rarely or never ascends a stream that has not one or more lakes at its headwaters, and the spawning grounds are usually in small streams tributary to such lakes or rarely in the lakes themselves." The average weight is about seven pounds, varying according to sex or condition. While dead, king salmon were occasionally seen floating down the Kenai River, some of which must have weighed 60 pounds, the kind coming under the writer's particular observation, were the red salmon, the most graceful and active of the western salmon.

When these fish first come from the sea they are plump and vigorous and their silvery forms often gleam high above the surface of the waters in the slow advance to the spawning ground. Gradually the colors change to a light pink and then by degrees to a deep, blood red, splotched with yellow, when they resemble gigantic gold fish. At a later period the body becomes gaunt, the head narrow and dark green, exhibiting gleaming rows of shark-like teeth, and then this once beautiful salmon of the high seas becomes reptilian in form and disposition.

It was in the quiet, shallow pools of the inside channels of the upper Kenai River, between long islands and the shore, where the milky glacial silt was precipitated to the bottom and the waters became clarified that the writer was able to observe and study for a number of days the action of the imprisoned fish.

One hardly realizes in traveling on or along a glacial stream how beclouded are such waters. At the junction of the Kenai and Russian rivers this becomes strikingly apparent, where the latter, fed by the springs from the lower hills, is unusually clear, even though hundreds of dead salmon covered its bottom when we saw it. The photograph on page 470 gives a fairly good idea of this contrast.

Between August 29 and September 3

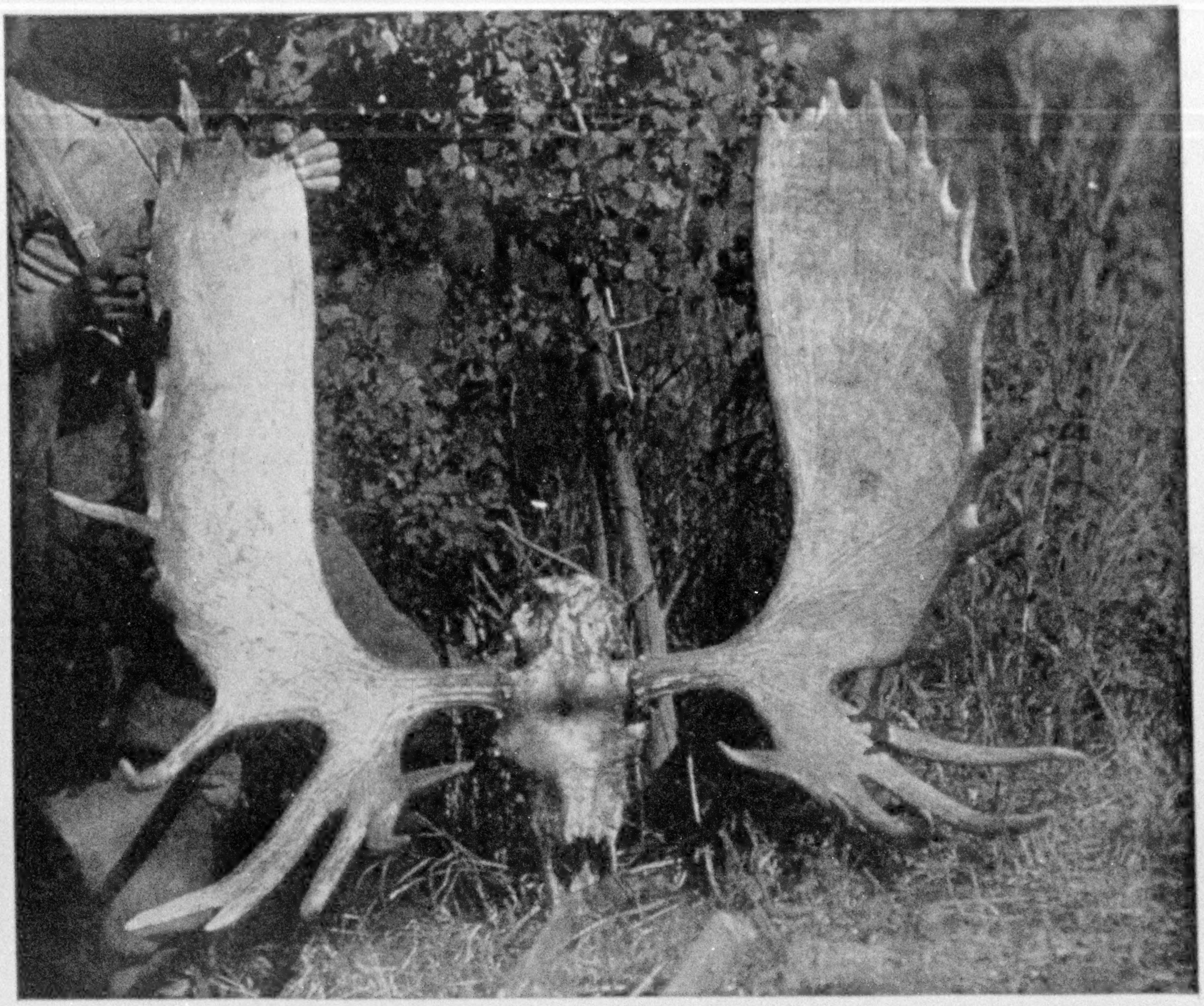

Photo by George Shiras, 3rd

A SPLENDID PAIR OF ANTLERS, WITH THE SKULL ATTACHED: FOUND ON THE BANKS OF THE UPPER KENAI RIVER

It is impossible to tell whether the animal died of old age or from wounds. Spread, 5½ feet. Note extraordinary brow antlers, which have a spread almost equal to the main branches (see page 453).

the gradually falling river had in many cases separated these pools by intervening bars, so that the fish, varying from two to a dozen, could be watched and the individual relations of each easily determined. While it was at once seen that the salmon were carrying on a continual warfare, it was not until the close of the first day that I found that the fish were paired apparently by hate and not by any ties of affection.

Whether this was a sexual antipathy I could not then determine, although as a rule only one fish was the aggressor, the other spending its time trying to elude the attack. Continuously and relentlessly they struggled in couples, rending and tearing the fins and tails, scoring with their sharp teeth the somewhat smoother sides, and occasionally seizing, with wide-open mouth, the nose or lower jaw of their victim.

On the four days spent returning up the river, and while the men toiled at the tracking line, I walked slowly along the banks, carrying a pack containing the more valuable part of our outfit, and so there was plenty of time to observe the salmon. From my notebook the following extracts depict what was happening much of the day:

"In one pool, separated by shallow water from the others, there were ten salmon and all in a state of fierce con-

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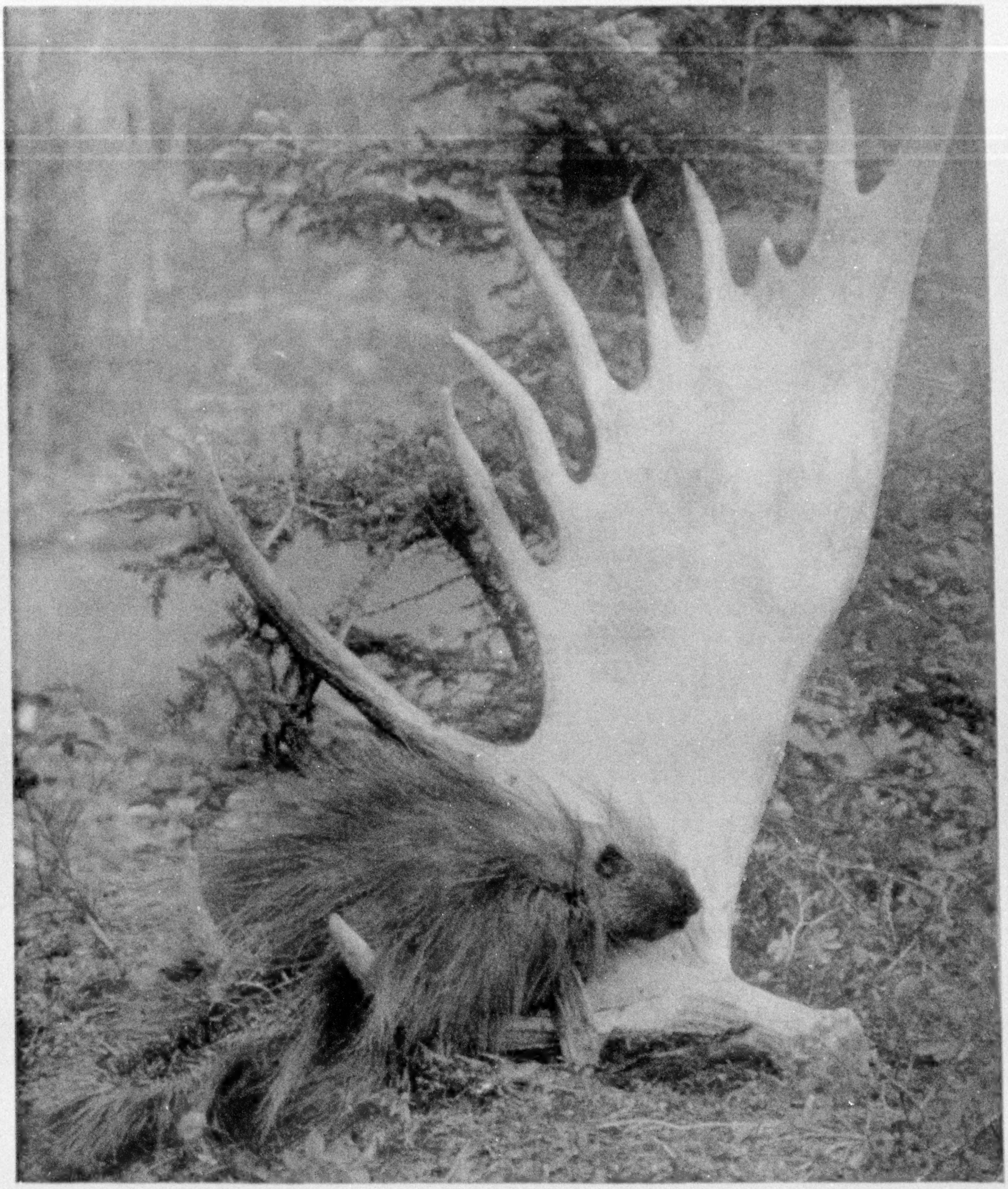

Photo by George Shiras, 3rd

YELLOW-HAIRED OR NORTHWESTERN PORCUPINE, WHICH HAD COME TO GNAW ONE OF OUR SHED ANTLERS

It became necessary finally to suspend these horns on wires from trees to escape porcupine and squirrels. "During the several weeks spent in studying and photographing moose near Skilak Lake, the network of runways throughout the poplar and birch thickets showed very plainly that this was one of the great winter feeding ranges of these animals, and that a systematic search would doubtless reveal many fine antlers. In this we were successful from the start, and nearly every afternoon, on taking the canoe for camp, one or two big or oddly shaped horns were a part of our cargo. And if the camera failed in its quest on such occasions, here were the discarded crowns of the giant moose, many of them worthy of portraiture and many of permanent preservation. By carefully noting the course of our rambles, in less than a week a square mile was pretty well covered and brought to view 26 nearly perfect antlers, aside from nearly an equal number found in the bordering spruce forests, which the porcupines had, with few exceptions, badly gnawed."

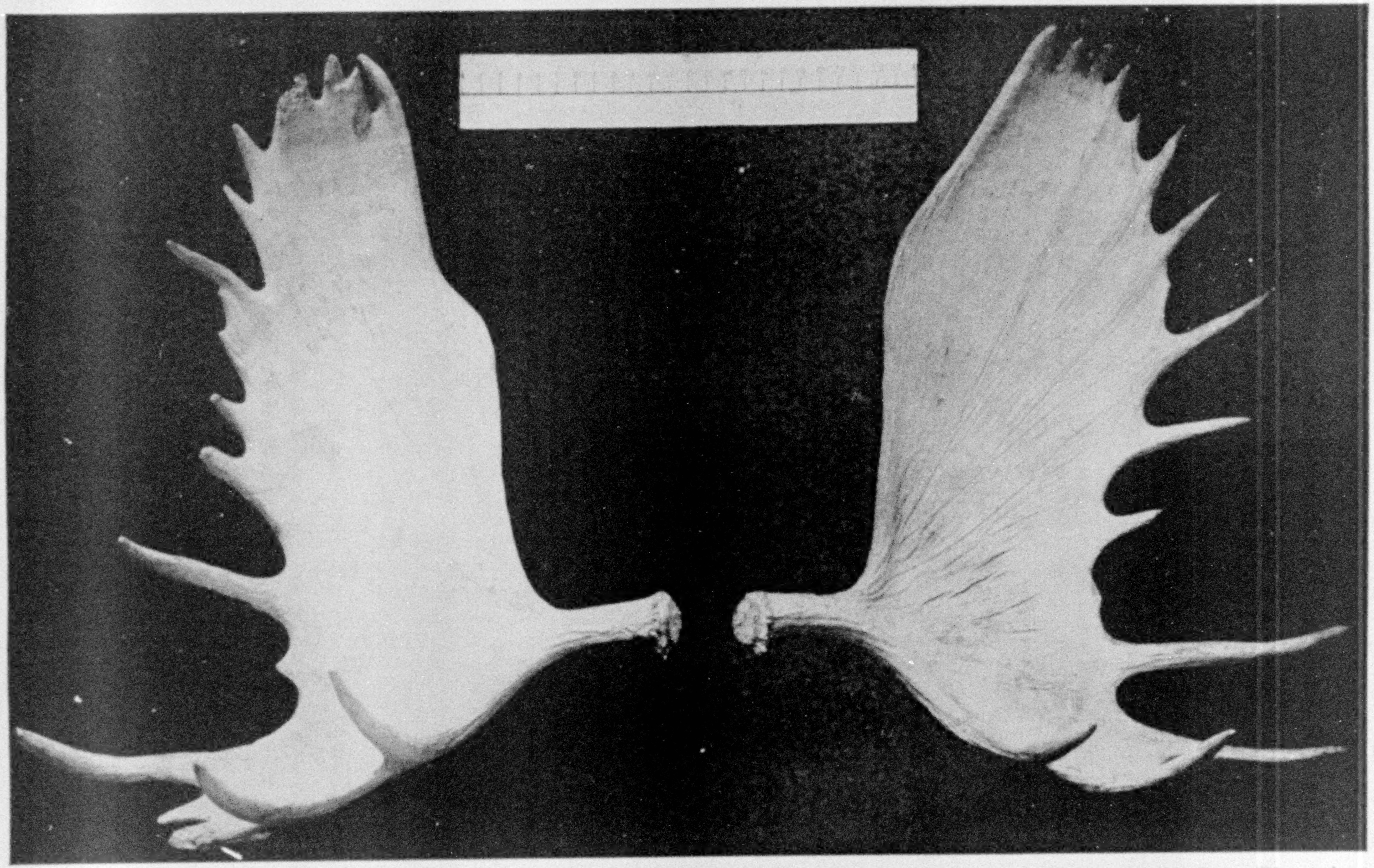

Photo by George Shiras, 3rd

A VERY LARGE PAIR OF SYMMETRICAL HORNS AND NOTICEABLE FOR THE ABSENCE OF ANY DIVISIONAL SEPARATION OF THE BROW ANTLERS, THE PALMATION BEING CONTINUOUS IN EACH ANTLER

Contrast these with the large and distinctive brow antlers shown on page 462. The spread of these antlers doubtless exceeded six feet. A two-foot scale is shown at top of picture

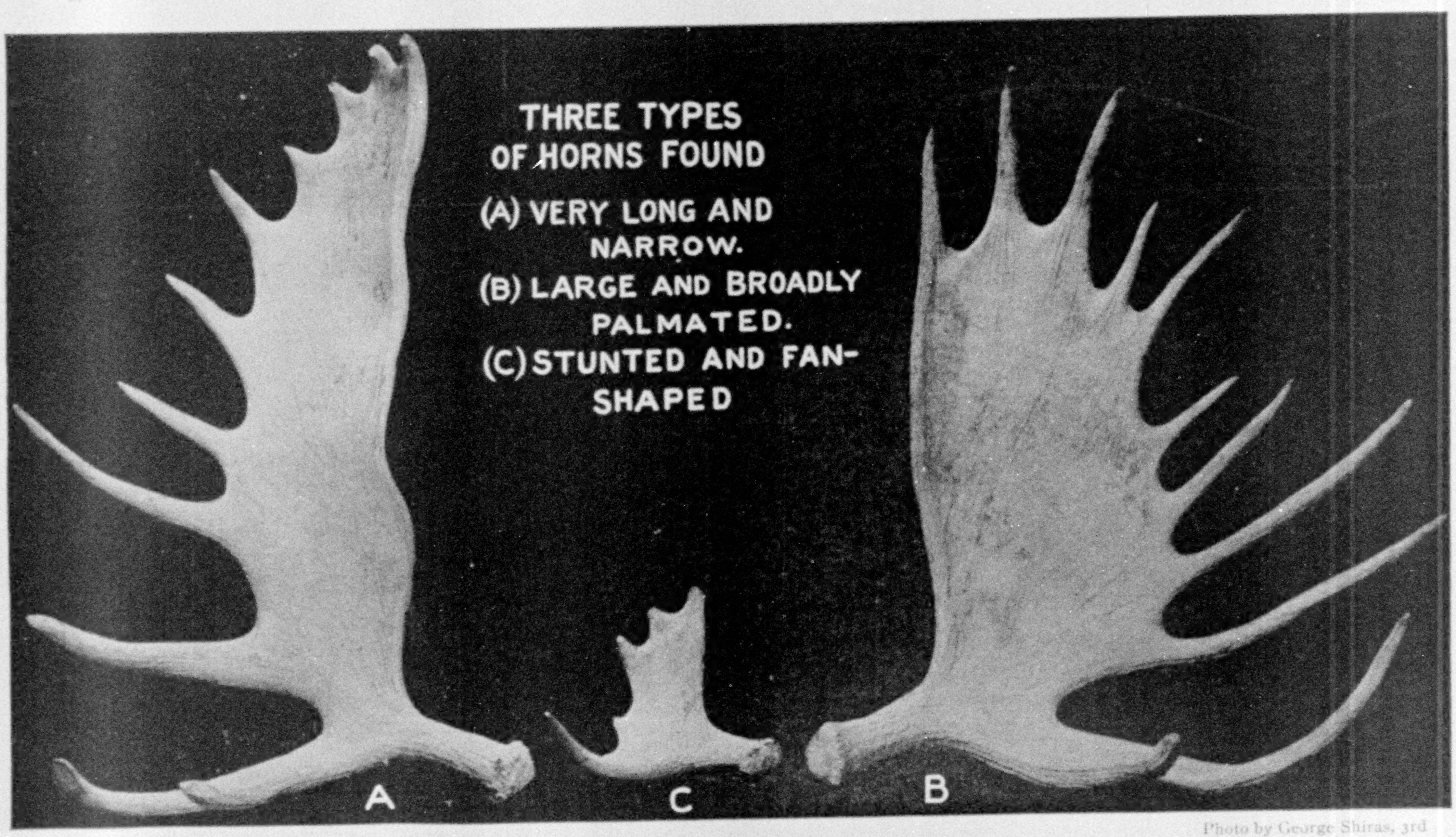
THREE TYPES
OF HORNS FOUND
(A) VERY LONG AND NARROW.
(B) LARGE AND BROADLY PALMATED.
(C) STUNTED AND FAN-SHAPED
A
C
B

Photo by George Shiras, 3rd

THESE HORNS REPRESENT THREE DIVERGENT TYPES OF ANTLERS FOUND DURING OUR EXPEDITION: PHOTOGRAPHIC SCALE IS THE SAME AS IN THE PRECEDING PICTURE (SEE PAGE 453)

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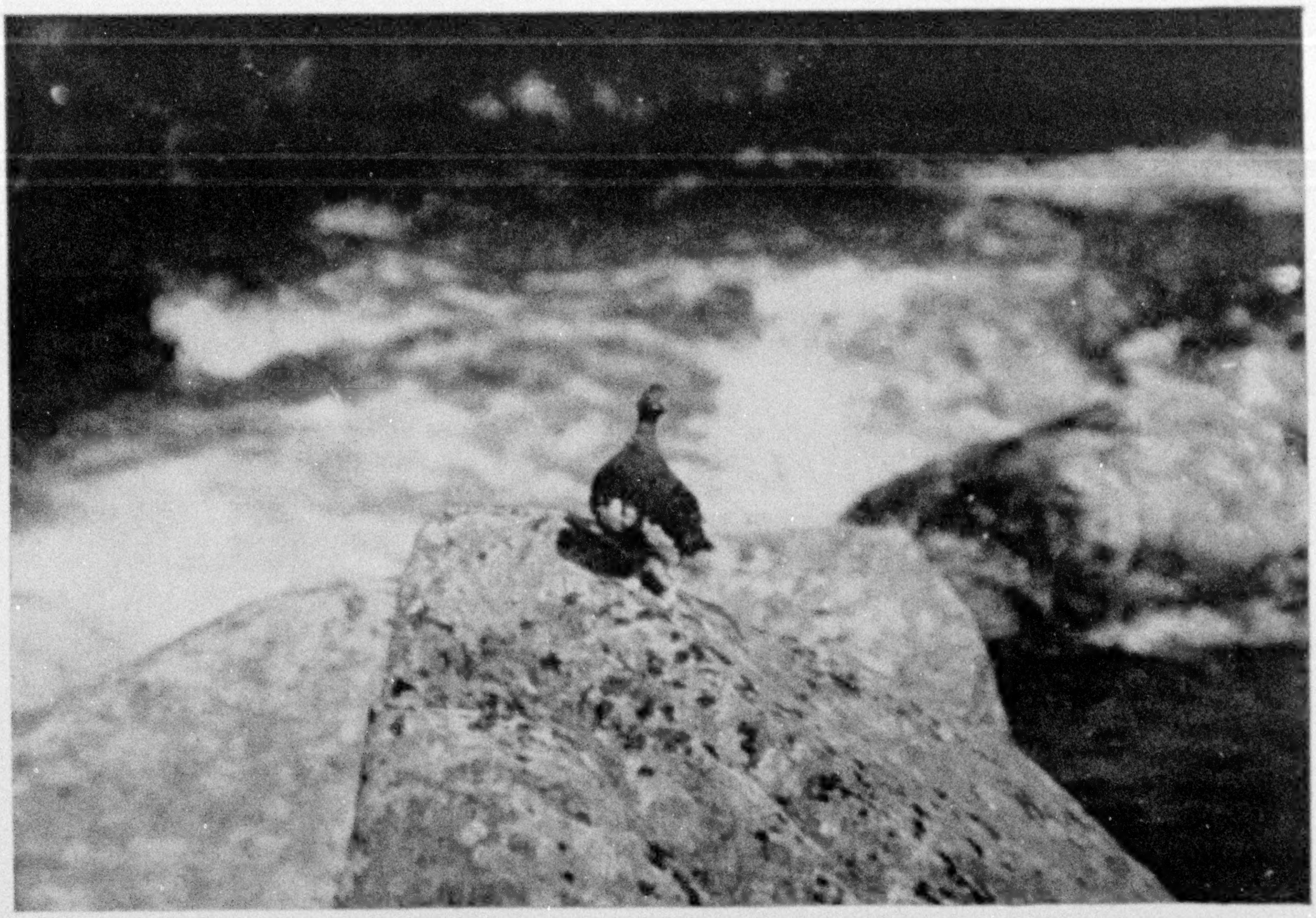
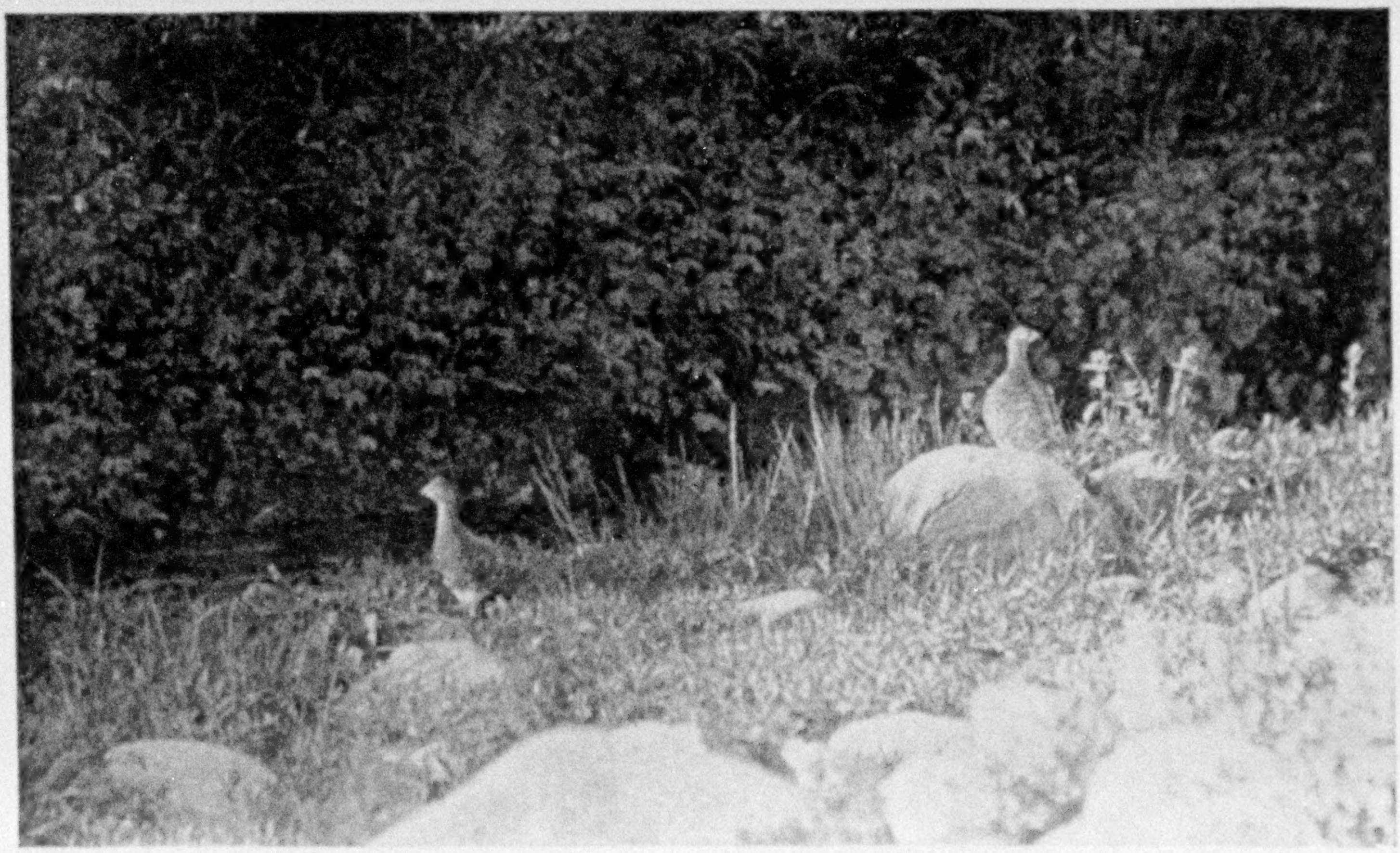


MALE OF WILLOW PTARMIGAN ON ROCK IN ROARING STREAM



Photos by George Shiras, 3rd

PARENT BIRDS OF WILLOW PTARMIGAN GUARDING RETREAT OF THEIR YOUNG

The birds show remarkable cunning in enticing enemies away from their young. For the story of these pictures see pages 454 and 455 tention. Two of these pairs were so uniformly persistent in their movements that I noted the same carefully.

"In one case the attacking fish would drive its unresisting companion half out of the water on the lower bar by biting vigorously at the tail, and then leaving it stranded in the scorching sun would return to the upper end of the pool until the other fish, after slowly wriggling its body around, would re-enter the pool, when the attack would be renewed in precisely the same manner. This continued during two hours' observa-

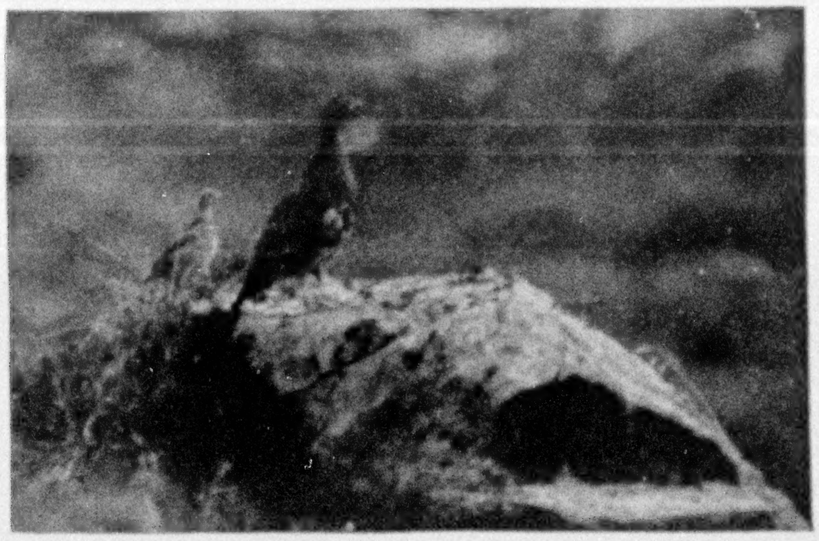


Photo by George Shiras, 3rd

FEMALE OF WILLOW PTARMIGAN STANDING ERECT, AND WITH THE YOUNG STANDING IN INSTINCTIVE IMITATION

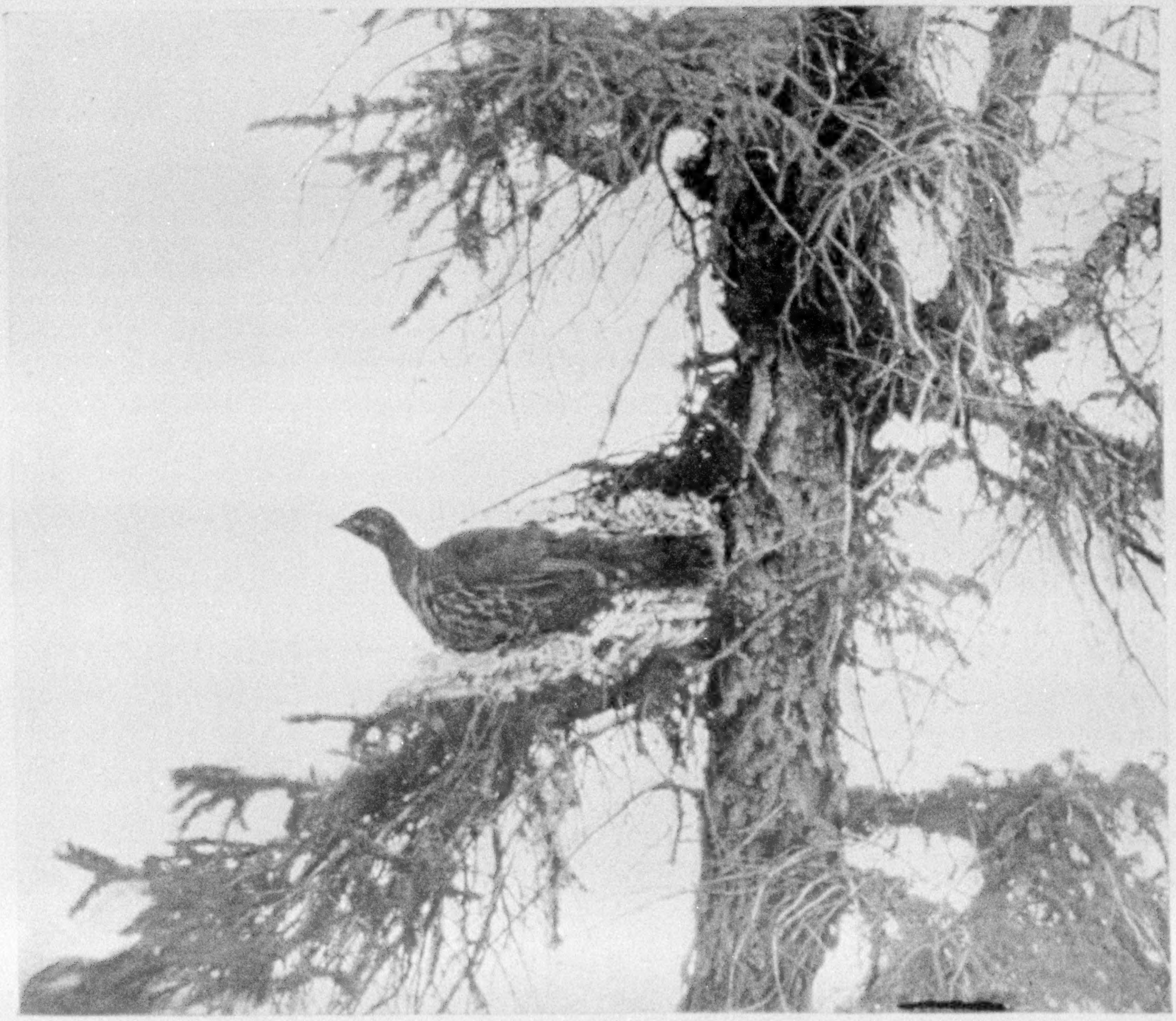
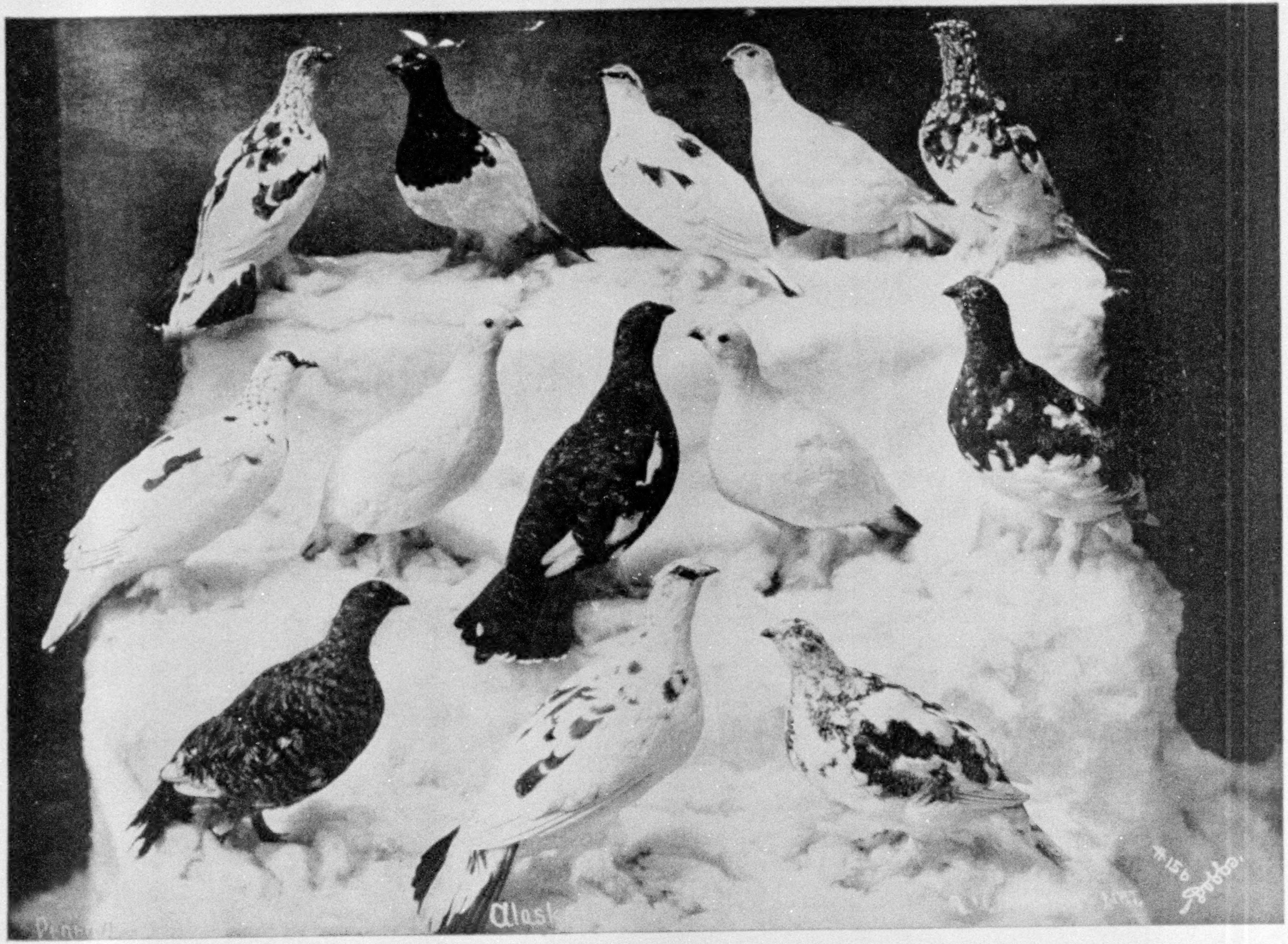
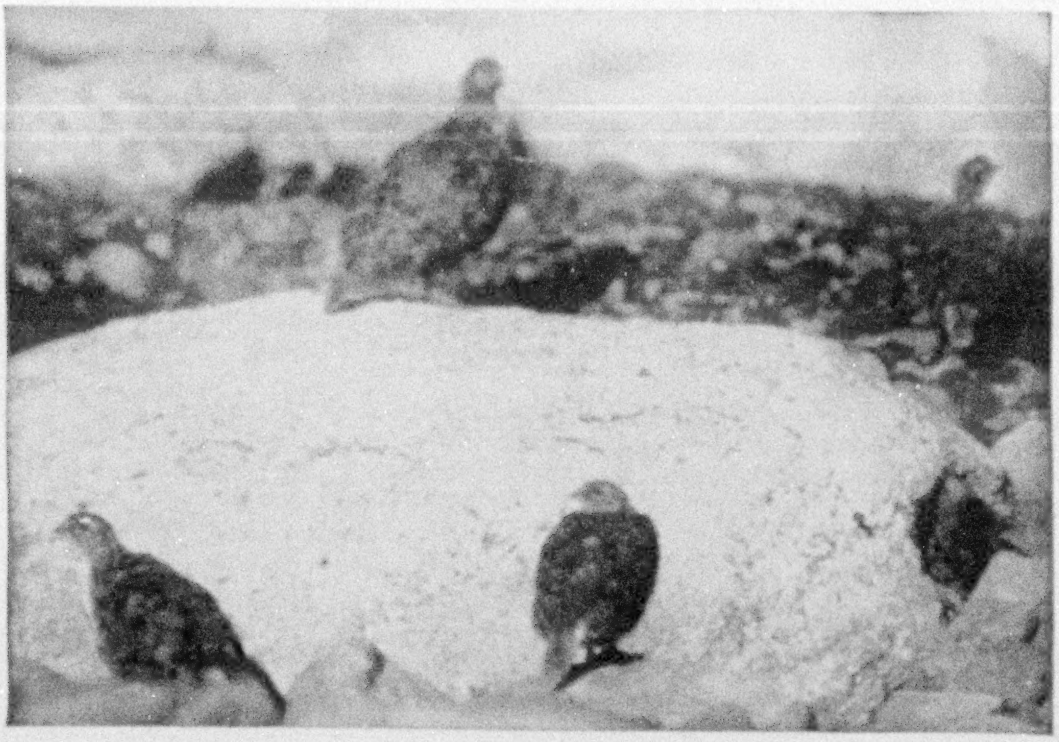


Photo by George Shiras, 3rd

FEMALE OF SPRUCE PARTRIDGE

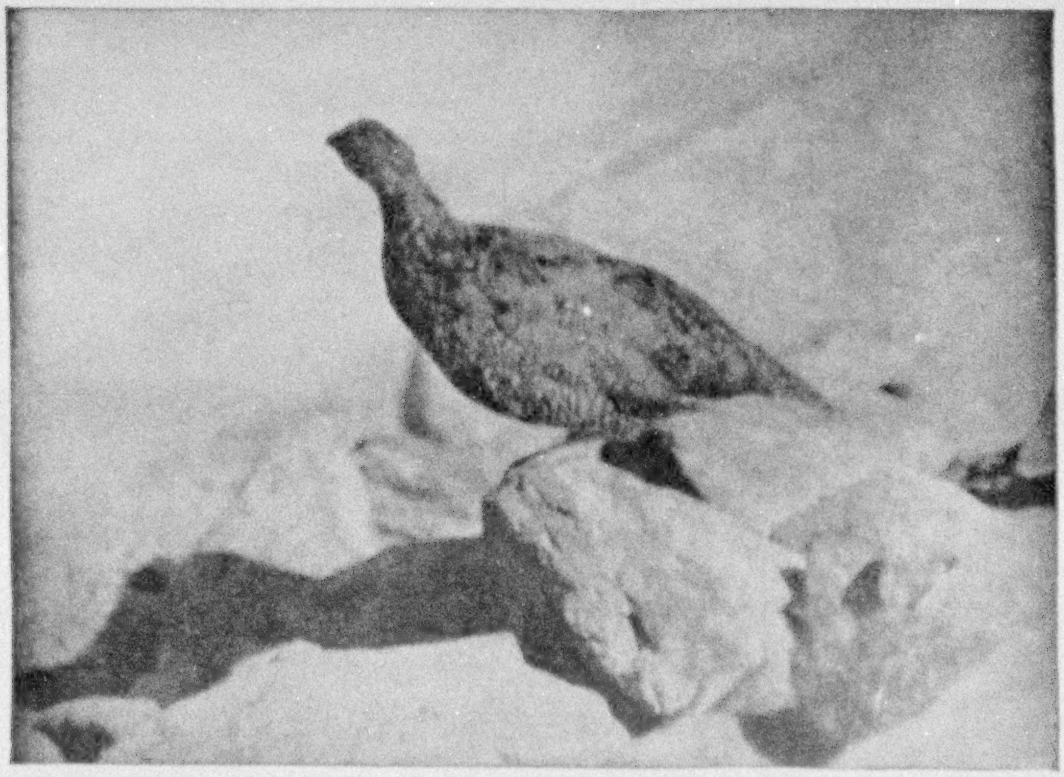


A MOUNTED GROUP OF WILLOW AND ROCK PTARMIGAN, SHOWING THE WINTER (WHITE) AND SUMMER (DARK) PLUMAGE, WITH THE INTERMEDIATE SPRING AND FALL DRESS. PHOTO BY BEVERLY B. DOBBS, OF NOME



FEMALE AND THREE YOUNG OF THE ROCK PTARMIGAN

The subdued and grayish-brown plumage make a photograph of the four birds difficult without a background of white



Photos by George Shiras, 3rd

FEMALE ROCK PTARMIGAN, PHOTOGRAPHED AT FIVE FEET

"The hen had two warning notes for the young, one causing them to remain stock still or crouch wherever they happened to be—and so faithful was the obedience that I could pick the young up—and another note, which caused the young to immediately seek an overhead protection, either beneath the broken rocks or under the rims of snow or ice. Once I saw seven small ptarmigan run beneath the edge of a block of ice, and all I could see was the projecting row of small black bills; and in another case the young bird, alarmed by the mother's note, squeezed in between my shoes and remained there until relieved by a reassuring call" (see pages 456, 457).

XUM

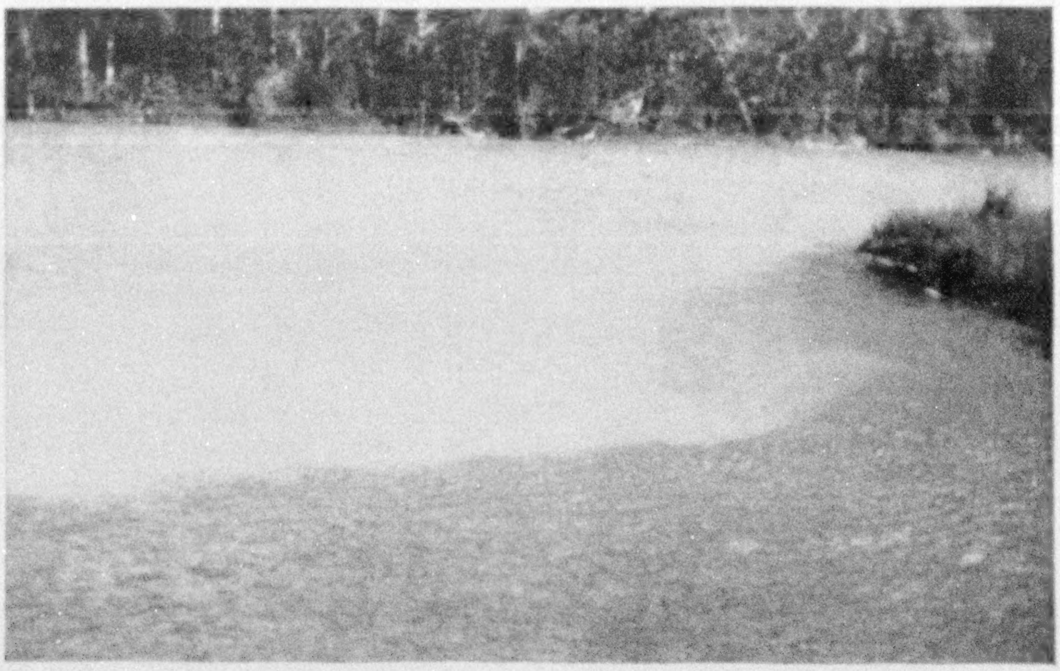


Photo by George Shiras, 3rd

JUNCTION OF THE KENAI AND RUSSIAN RIVERS, SHOWING THE MILKY, GLACIAL WATERS OF THE FORMER COMMINGLING WITH THE CLEAR, SPRING-FED WATERS OF THE OTHER (SEE PAGE 461)

tion, and in that time the victim of this relentless pursuit was driven on the bar about one hundred times.

"In the second case the pair swam side by side in a circle and seemed amicable enough until the inner salmon gradually crowded the other on to a shoal, when it would drop back and seize the tail of its helpless mate and, after rending it for a moment or so, the two would begin circling again.

"The remaining salmon in the pool were carrying on contests more or less similar. In no case did they interfere with another fish except when it got in the way or tried to occupy a position reserved by the others."

The possible explanation for this strange conduct—and the subsequent suggestions come largely from those better informed upon the habits of these fish than the writer—is this: (1) That the imprisoned fish had not yet spawned (corroborated by the fact that I saw no dead or dying ones in these pools); (2) that the female, restrained by the instinct from depositing her eggs except in small streams tributary to lakes, refused to spawn, even though the period was about over; and (3), that the male fish, mated from the time of leaving the sea, had not only become infuriated at the conduct of the female, but likewise angered by confinement, was venting his rage upon a mate in no wise responsible for the situation—a trait not always confined to the male of the fish tribe.

I found it difficult, if not impossible, to get satisfactory photographs of these battles, for the lens loses its power to penetrate the water whenever the surface is broken or ruffled from any cause. The pictures accompanying the text illustrate this, where a slowly moving salmon is plainly to be seen below the surface; while where the two pair were fighting, only the portion out of water is visible (see picture, page 471).

In the main channel of the river and its tributaries, where there was plenty of water for the fish to move about freely, I saw only an occasional fight, possibly near the spawning beds, and the nervous energy of certain fish seemed directed against the swift current, with which they struggled desperately until repeated inhalations of air above the surface produced a delirium and death apparently by drowning; and that this was confined to those which had already spawned now seems likely. At tidewater, where swift and short mountain streams often bore many of the weaker fish into the bays, I saw one salmon tear to pieces seaweed, and in the final dash its teeth locked on an upturned strand of vegetation and thus it died. The next day I could see it, head down and tail up, swinging in

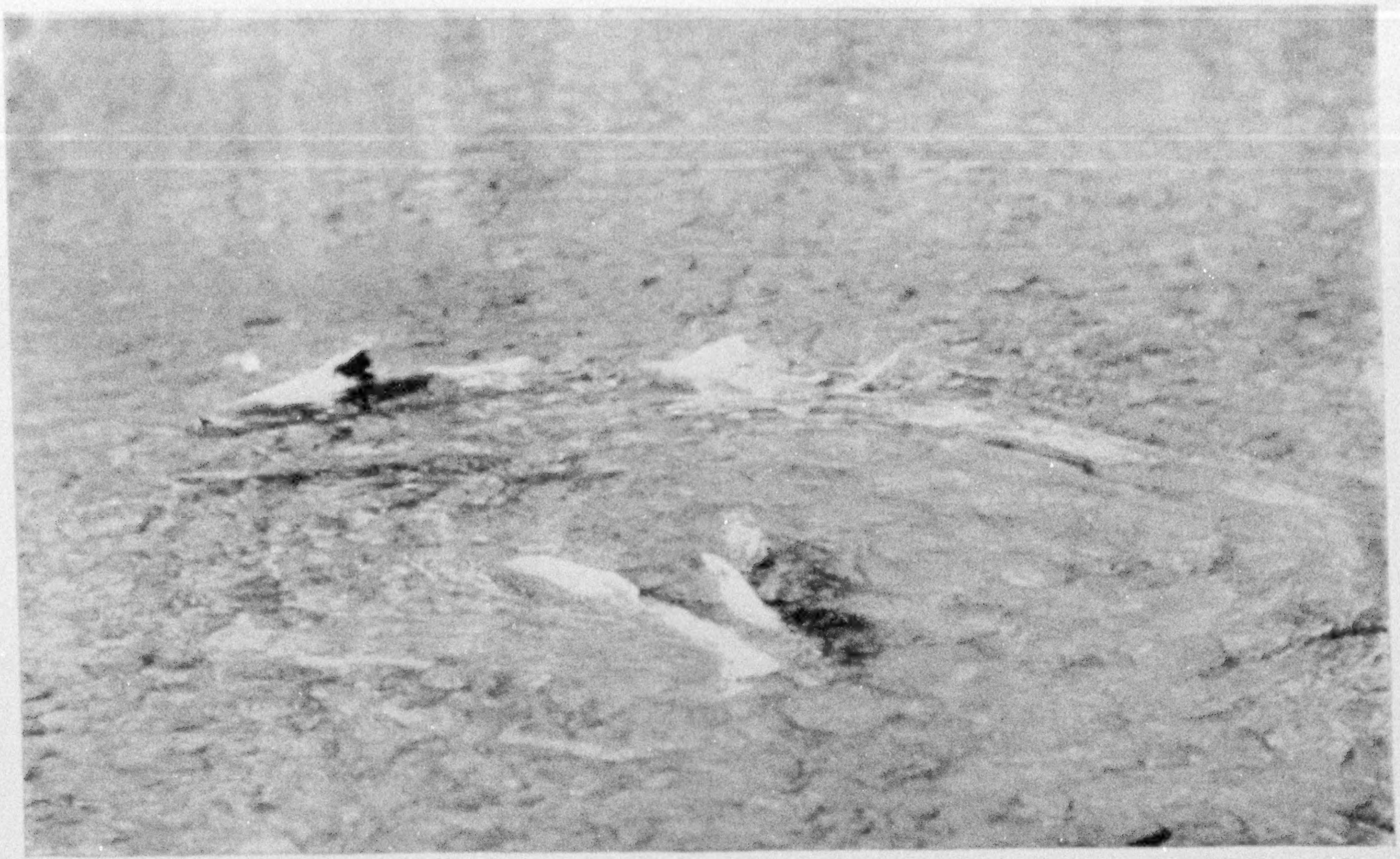


Photo by George Shiras, 3rd

SALMON FIGHTING IN KENAI RIVER

In the upper pair the rear fish is rending the tail of the other; in the lower couple the fish to the right has just bitten a piece out of the dorsal fin of the other (see page 462). "Continuously and relentlessly they struggled in couples, rending and tearing the fins and tails, scoring with their sharp teeth the somewhat smoother sides, and occasionally seizing, with wide-open mouth, the nose or lower jaw of their victim. In one pool, separated by shallow water from the others, there were ten salmon, and all in a state of fierce contention."

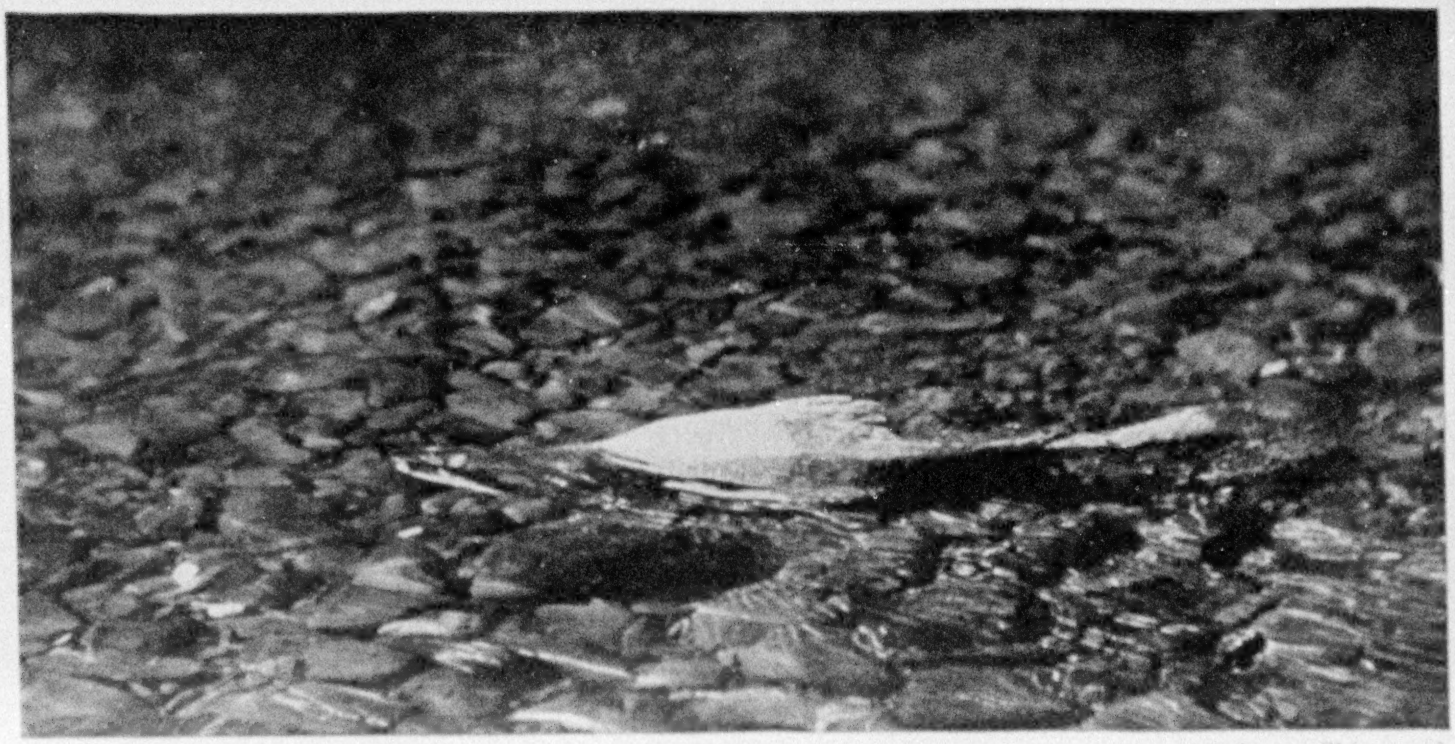


Photo by George Shiras, 3rd

THE IMPRISONED SALMON OF THE UPPER KENAI

A gaunt and fierce male, the under portion of the body deep red and that above the surface of the water a dirty and festering yellow (see pages 457-466)

XUM

the tide. Thus even the brine of the ocean had no restorative effect.

In such bays, owing to the higher temperature and the greater buoyancy of the salt water, the dead and dying salmon usually floated on the surface, and it was a gruesome sight to see hundreds of gulls, poised on wing, awaiting the moment when they could alight safely upon the body of a fish and pluck out both its eyes, as it rolled over and over in the final struggle.

That death should be the penalty of parentage for all the salmon of the Pacific is generally regarded as one of nature's mysteries, and deepened by the safe return of the North Atlantic salmon to the sea.

But in this number of this Magazine appears an article by one of the leading fish experts of the country, Dr. Hugh M. Smith, Deputy Commissioner U. S. Bureau of Fisheries, and therein is explained why the salmon of adjoining oceans meet a different fate in the rivers of the North.

THE WHITE SHEEP OF KENAI PENINSULA

Before taking up the narrative of the happenings in the sheep country, it may be well to state the plans arranged in advance.

On examining game pictures from Alaska, I was struck by the scarcity of those representing the white sheep, either singly or in flocks. As hundreds of the most experienced sportsmen, from nearly all countries, had pursued these animals, I had considerable doubt of success, even though having a marked advantage in a better equipment and in making my main object what in the case of the others was largely incidental.

Therefore I decided to locate and study the animals first, with the purpose of securing information about their habits and then, if possible, making use of the knowledge thus acquired to get within photographic range. Otherwise it might happen that were I to immediately begin harassing the sheep with the camera at close range I would get neither pictures nor information.

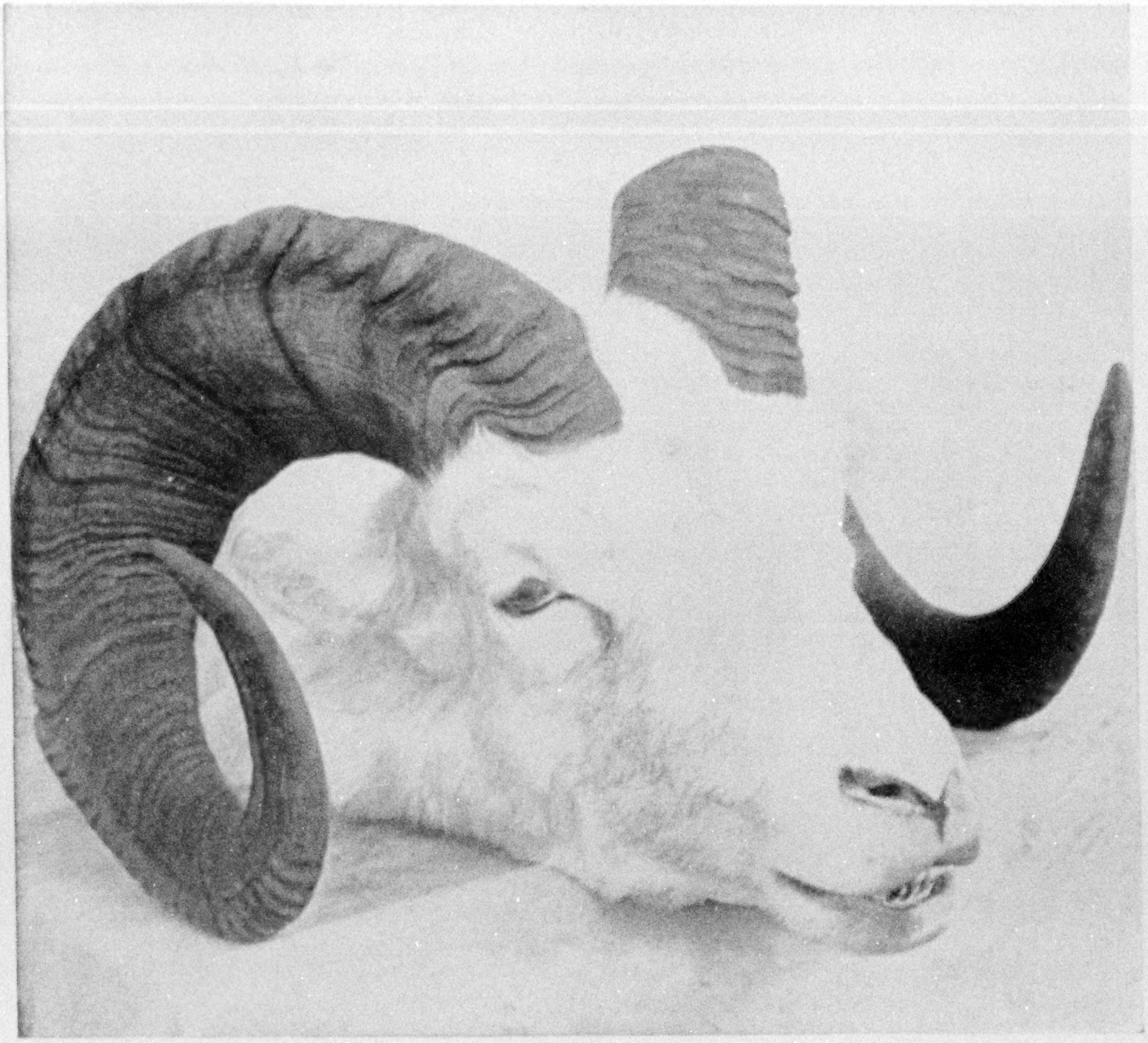
Ten days were spent in the mountains, four of which were entirely used in going and coming; and, while the six days devoted to sheep, and incidentally to ptarmigan, resulted in a fair collection of pictures, the results, I think, fully justified the procedure laid out in advance and mentioned now specifically with the view of aiding those who, in days to come, may wish to visit the scene of these brief but strenuous efforts.

Several days before starting for the interior, my old Michigan guide, John Hammer, joined us. His long-continued trips into the wilderness, and in this instance reinforced by his Norwegian blood, made the call of the North irresistible. The addition of a third man, just as we were about to undertake the hardest part of the journey, proved fortunate, and greater still when the swift waters of the Kenai River had to be overcome on our return to Seward.

At 6 o'clock on the morning of August 5 we were ready to leave Double-bay camp for a ten days' trip to the sheep country; and, with Tom and John in the heavy skiff and Charlie and the author in the canoe, the start was made for the southeast corner of the lake, just opposite the bird islands. The weather was bright and the barometer still predicted a continuation of the fine weather, so exceptional in weeks past.

On rounding the point we saw, in the morning light, the black and frowning features of volcanic Redoubt, and, a little further seaward, Iliamna's snowy peaks, 100 miles distant and on the other side of Cook Inlet. Our immediate destination, Cottonwood Creek, was reached in less than two hours, where, after placing our surplus outfit on a porcupine and bear-proof platform, made by Tom the previous season, a start was made up the mountain creek. This stream originates in a big snow field just beyond the divide, over which we had to pass on the way to Benjamin Creek, the location of Tom's cabin, where he lived during a long and vain search for gold. Though no valuable metals were found, the locality is memorialized on the map by calling the creek Benjamin, the Christian name of his eldest brother.

The ascent was a hard one, for the day was hot, the underbrush a nuisance, and



A TYPICAL HEAD OF WHITE RAM

In 1884 E. W. Nelson first described a pure white species of mountain sheep inhabiting Alaska and northwestern Canada, naming it *Ovis dalli*, in honor of Prof. Wm. H. Dall, the well-known scientist and Alaskan explorer. While the horns of this species are not as massive as those of the Rocky Mountain Big Horn, or the base circumference equal to that of the Big Horns or to those of the southern California species, the extensive spread and graceful symmetry, in connection with the beauty of the head, makes it the most-prized trophy of its race.

the packs heavy. Gradually I shed all extra clothing and then lightened my pack, the guides good-naturedly picking up the discards as they fell by the wayside. At noon the tree-limit was reached, half a mile this side of the divide, and there on a rounded knoll, with plenty of stunted hemlock for firewood, a small tent was erected for me to spend the night in, while the three men returned to the lake to bring up another load in the morning (see picture, page 474).

On their departure I lay on a cushion of moss and for many hours swung the field-glass, now into the valleys, then upon the foothills and peaks, then down upon Skilak Lake and across the great untrodden tundra, with its many glistening ponds—the summer nursery of the moose. Most interesting of all this limitless scenery was Cook Inlet, looking like a giant river and banked on the western side by the mountains of the Alaska Range, the great cordillera of the Territory, with Mount McKinley as the keystone in the semicircular swing of this great upheaval.

But later my interest became centered

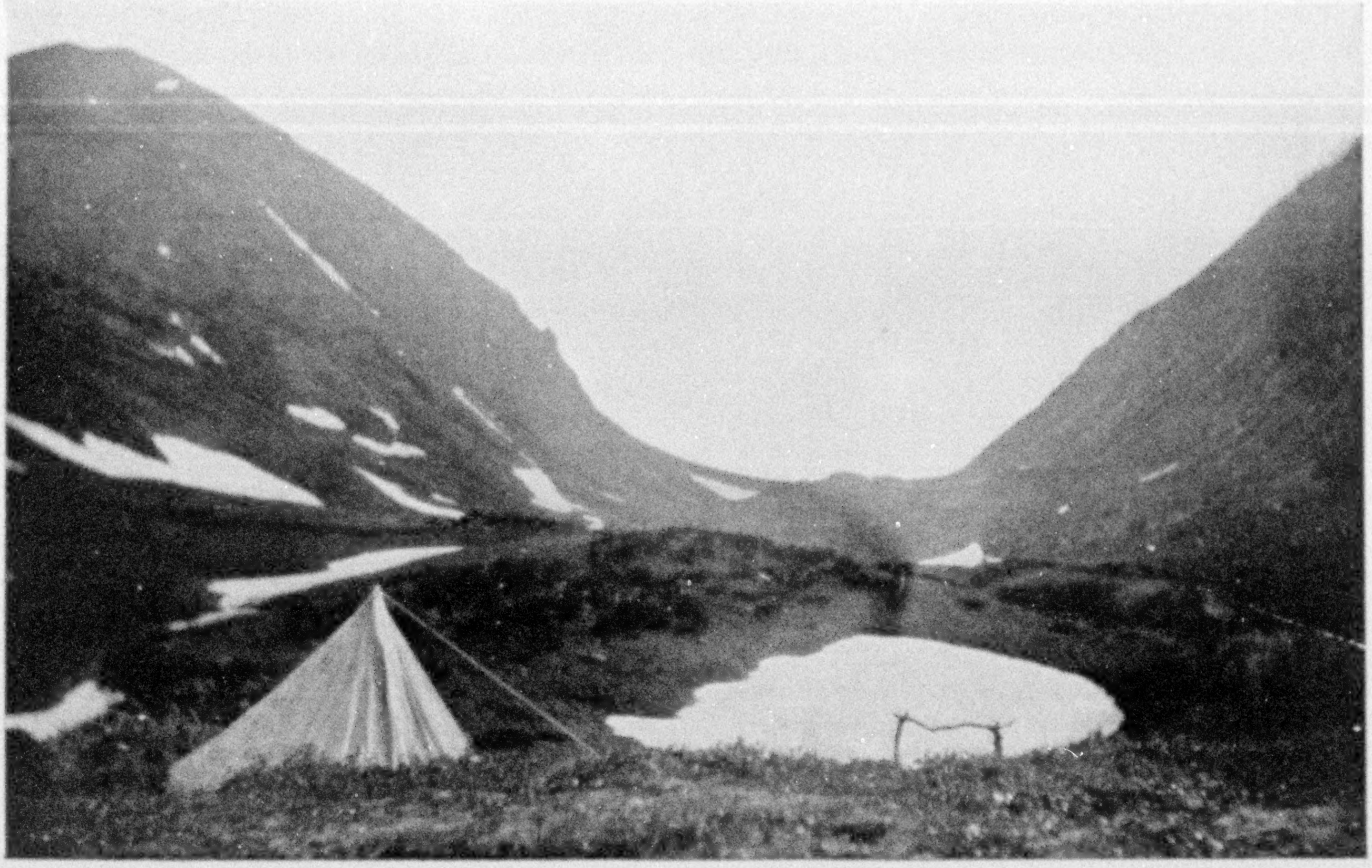


Photo by George Shiras, 3rd

ENTRANCE TO THE SHEEP COUNTRY: LOW DIVIDE 3,000 FEET ABOVE SKILAK LAKE, WHERE THE AUTHOR CAMPED ALONE THE FIRST NIGHT (SEE PAGE 473)

in the animals and birds which, in the shadows of the declining sun, came out of thickets of evergreen and willow. At one time I could see a dozen porcupine—black-haired and of the Canadian species—feeding stolidly as sloths on the fresh vegetation bordering the receding snowbanks.

A cock spruce partridge came within five feet of the tent, evidently mistaking it for snow; a brood of willow ptarmigan were seen in the willows just above, while higher up a fox brought to view a covey of rock ptarmigan, heretofore described (see page 457). Moose signs were plentiful, but no moose were seen. The air about resounded with clear notes of the hoary marmot, the mountain woodchuck of the North (see pages 434, 435). Then came the mosquitoes, the post-season crop of the higher altitudes, when the insect-proof tent became a place of refuge for the night.

On the following morning I had hardly finished breakfast when along came the men, red-faced and tired in the fight against gravity and the worst of mountain trails. An hour later we were climbing over the broken rocks littering the floor of the divide, and thence entering a great plateau sloping southerly to Benjamin Creek. For the rest of the day we struggled through bushes, stumbling into grass-covered cracks, leaping from tussock to tussock, and circling about swamps and mud-holes.

In the midst of all this turmoil Tom pointed out round dots of white on a distant ridge which looked like weathered boulders or snowballs from the frozen fields above. These were the white mountain sheep of which we were in search.

When I asked Tom, somewhat hopefully, whether it would not be wise to begin the camera hunt at once, since it made no difference whether we frightened these sheep or not, he politely concealed a negative answer by saying that if I would circle two miles to the left, ascend the mountain top from the rear, he would drive the sheep toward me before dark. This didn't seem like getting to Benjamin Creek on schedule time; but as Tom assured me, in a sympathetic tone, that I would see four or five sheep

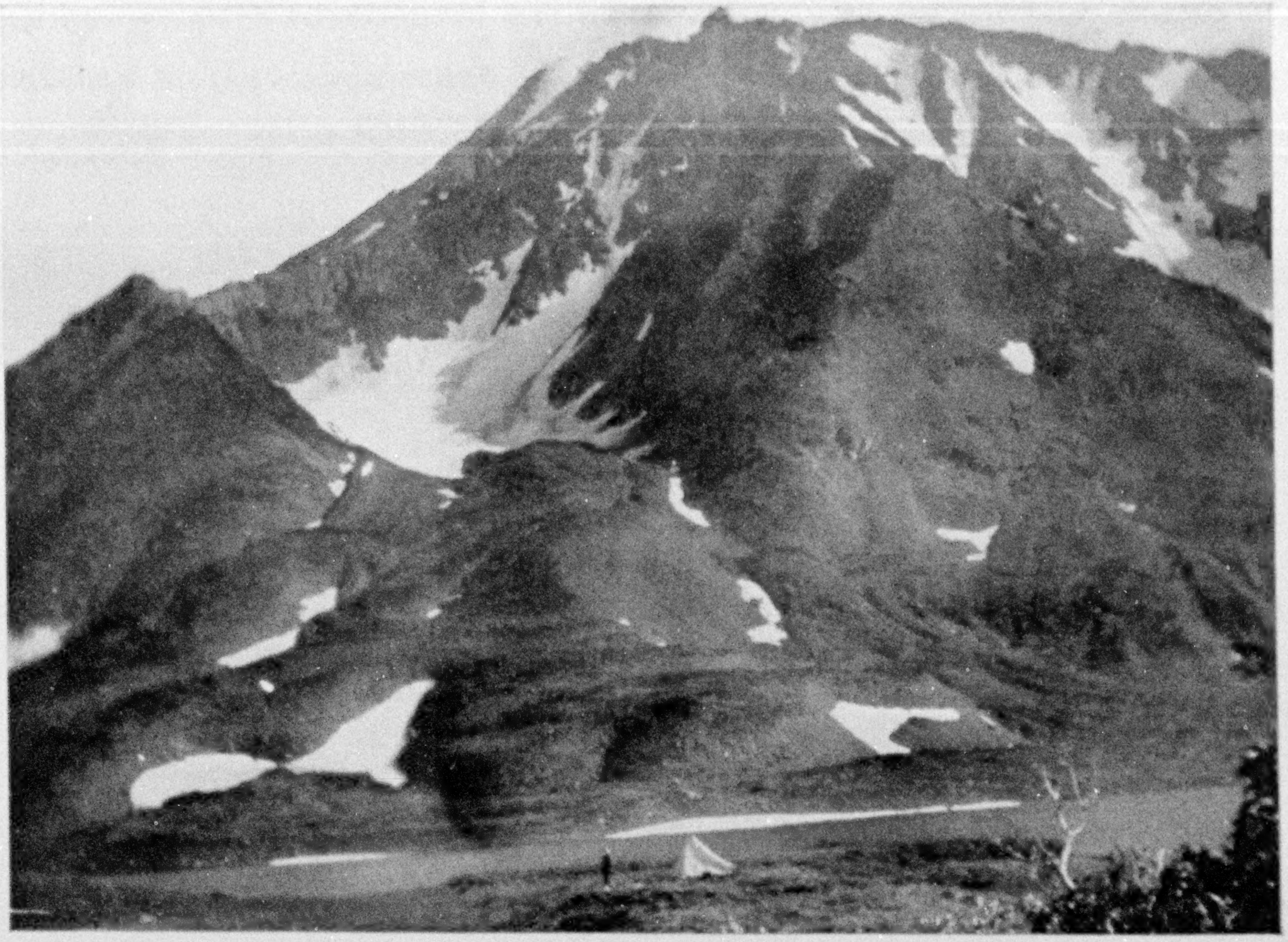


Photo by George Shiras, 3rd

THE MOUNTAIN SLOPES OF THE SHEEP COUNTRY

"Big Pond camp" in the foreground, situated midway between the cabin on Benjamin Creek on the west and the great ice cap on the east. The author camped alone here several nights while photographing the white sheep. Two Alaska bear visited the tent one night (see page 477).

near his cabin to one here, the march was continued, and at six in the evening the cabin came suddenly in sight, 200 feet below a terrace bordering the valley of the creek. John and I were quite used up, the former still suffering from the after-results of typhoid fever, contracted on our trip the previous year to Mexico, and I on general principles.

But soon the restorative effect of a hearty meal and the inspiration of the surroundings gave me sufficient energy to climb a hill behind the cabin, and there, at 8 p. m., I could see, at the headwaters of Benjamin Creek, three different bands of sheep, all preparing to spend the night on little open benches not much above the meadows. Such a sight told the story of a country seldom visited by man and where these aboriginal pastoral flocks felt secure by night and day.

BIG POND CAMP

At 8 o'clock the next morning we were ready to start after sheep, leaving John in charge of the commissary department. Following the creek east half a mile, we then went up over a series of sloping meadows for a distance of three miles.

A little above the cabin three small streams come together and, in combination, form Benjamin Creek. One flows in a zigzag course from the snow fields just this side of the low divide above Skilak Lake, where the melting snow is likewise the source of Cottonwood Creek; another carries the overflow waters of a big pond, in the highest meadow to the east, and the third drains several large valleys in the southeast.

The two latter streams, lying between the highest and steepest mountains in the neighborhood, cut deeply into upland

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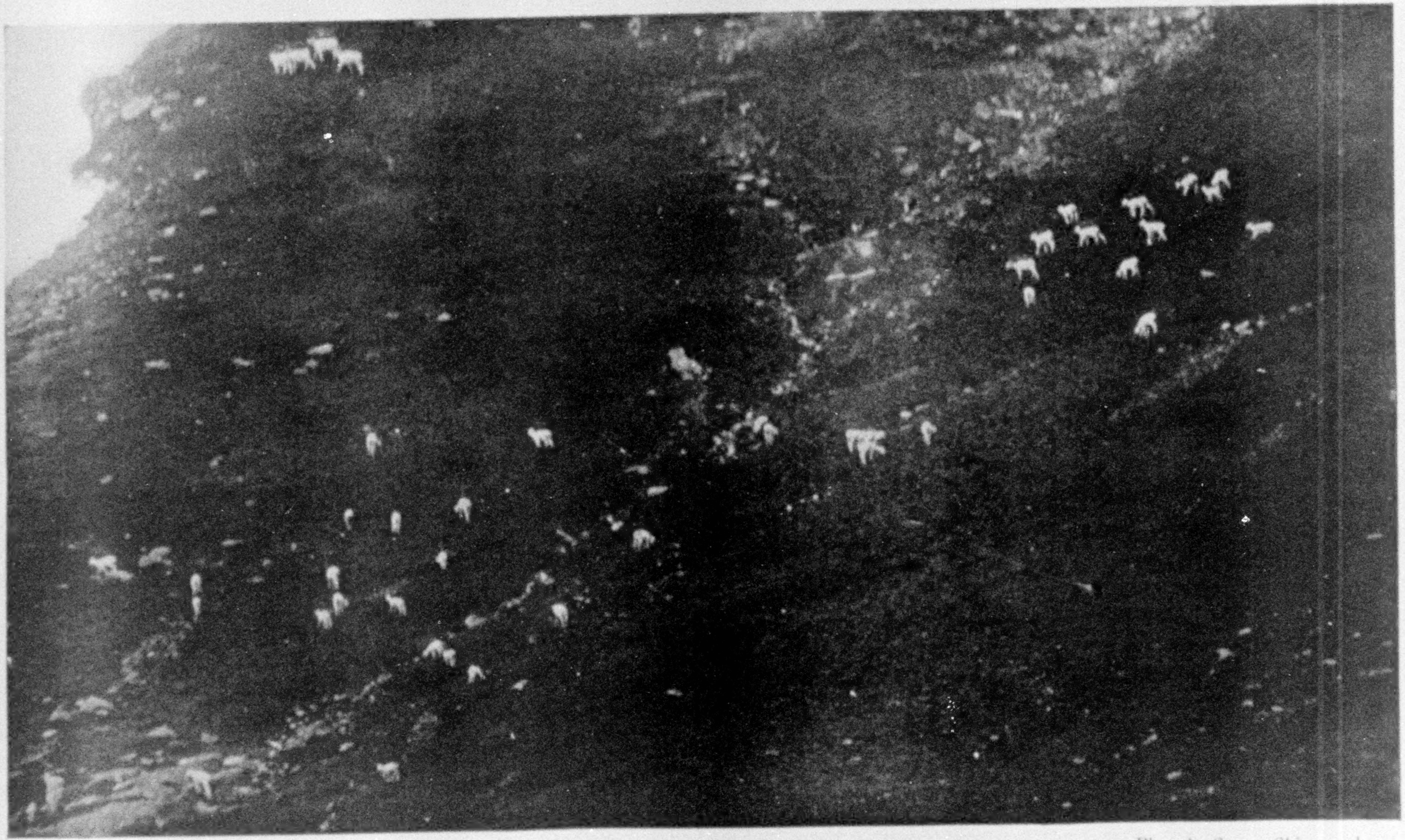

Photo by George Shiras, 3rd

TYPICAL VIEW OF SHEEP ON HIGH SLOPES BORDERING THE SNOW FIELDS, WHERE CONSIDERABLE FRESH VEGETATION IS FOUND FOR A SHORT PERIOD ON SPOTS RECENTLY COVERED WITH SNOW

The writer is not a believer in the theory of protective coloration when applying to the larger animals of this country, whatever may have been the effect of laws of nature regulating survival in prehistoric times, when the pelage colors first became constant and characteristic. Some of the smaller animals and certain birds, fish, reptiles, and insects, whose enemies are largely the same today as in the past, are undoubtedly preserved by obliterative or deceptive colors, as well as by concealing shapes. Confirming the first conclusion are the white sheep of Alaska, conspicuous for miles, and which never through apparent design sought the protection of adjoining snowbanks, however great their anxiety to escape detection or pursuit. Keenness of vision, or occupancy of a favorable lookout, and wonderful aptitude in inferring danger from the action or the absence of other sheep, constitute their main reliance.

meadows, which harbored not only the band of sheep I had seen the night before, but many others.

On the way up the valley we came to the last timber, consisting of spruce, mountain ash, and a considerable number of cottonwood trees, intermixed with willows and alders. At this terminus of the forest growth there were many moose trails and numerous fresh beds made by these animals in patches of grass between the willows. It was plain that the head of this high valley and the smaller ones containing willows were the summer resorts of the bull moose. Only two shed antlers were found in our extensive wanderings, one many years old, confirming my view that all the moose at such elevations returned to the shores of the lake and adjoining lowlands during the late fall and midwinter months.

On the few occasions that Tom had hunted sheep here he had always returned to the cabin at night; but, as this meant a waste of time and energy, it was deemed best for my purpose to erect a tent in the midst of the sheep range, so that I could have a chance to watch them almost continuously during the 18 hours of daylight.

An hour after starting we came to the pond, which seemed to be the best and most convenient location, commanding as it did three of the best sheep valleys, and yet not too close to interrupt the movement of sheep from one district to another.

The tent was placed on a little knoll, close to a fine spring, and where a great black mountain rising from the opposite shore of the pond afforded a striking background (see picture, page 475). Numerous adjoining knolls covered with glacial rocks were the homes of many marmots, who viewed my canvas home with surprise and protestation (see pages 434, 435).

After lunch we made a reconnaissance, locating an unusually large flock of sheep up a valley to the north which drained into the pond, and there we spent the remainder of the afternoon, with the sheep brought within easy inspection by the use of a powerful field-glass.

The wind was blowing straight up the valley toward the flock, but there was no indication that any of the sheep suspected our presence. Not only before coming north, but later, I knew of the conflicting views held by sportsmen and guides in reference to the alleged inability of sheep to detect the near-by presence of man through scent, and it was one of my purposes to make every possible experiment in this direction.

Late in the afternoon Tom and Charlie returned to the cabin, leaving me to spend the night in the tent. Before dark I watched scattered bands of sheep leave the meadows for the higher slopes, where gradually they gathered into several good-sized bunches.

At 9:30, when distant objects became obscure, I went into the tent, and while slipping into the sleeping-bag I happened to look out the wire ventilator in the rear canvas wall, noticing two large animals coming down a ridge a hundred yards back of the tent.

My first impression was that they were sheep, or possibly caribou, but when one rose on its hind legs and looked about, I could only conclude that a pair of the big brown bear of Alaska had come to the meadow for the purpose of digging out marmots or ground squirrels.

These animals have a bad reputation among miners and explorers, due I think to their immense size and their near relationship to the grizzly, around which many of the blood-curdling tales of this country have been woven. Based upon my own experience and the carefully sifted experience of others, I had long ago come to the conclusion that there are no dangerous wild animals whatever in the northern hemisphere, except the grizzly, and this only occasionally when molested.

Having no intention of interfering with these visitors, I felt little concern, although quite appreciating that it might be a dearly paid experience if I neglected taking such precautions as were then possible. So the little automatic revolver was placed by my side, the opening of the tent closed, and, when too dark to see anything further, I crawled into the canvas sleeping-bag. Once there seemed to be something sniffing behind the tent,

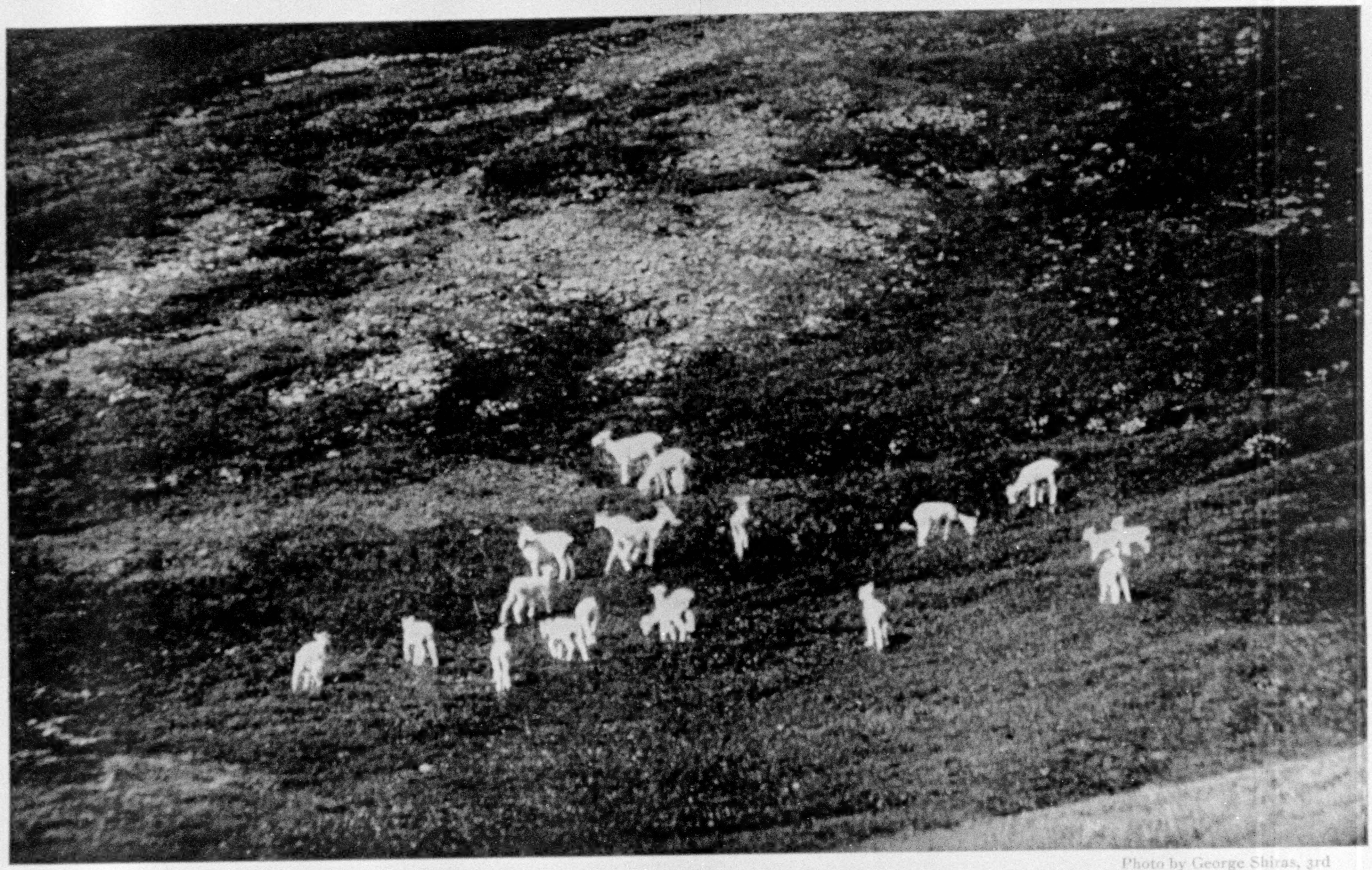

Photo by George Shiras, 3rd

THIS REPRESENTS A SMALL BAND OF SHEEP THAT HAS JUST COME FROM THE MOUNTAIN TOP TO A LOW MEADOW COVERED WITH FRESH GRASS AND SMALL PLANTS: SEVERAL LAMBS ARE PLAYFULLY JUMPING OVER THEIR MOTHERS (SEE PAGE 479) but there was no way of determining the question without going outside. Gradually my nerves quieted down and the next thing I knew was the buzzing of the mosquitoes in the morning, brought into activity by the early rising sun.

Several hours later Tom arrived with cooked food sufficient for three meals, and, after sampling some of this, we returned again to the valley where the sheep were seen the afternoon before. The big band had broken up again into small flocks and were feeding on the same meadows, some of them working down our way. The wind still continued to blow up the valley, but as I now wished to get some views of the sheep grazing here and there on the meadows and at the same time determine with preciseness just how close one could get before the scent created alarm, we cautiously approached.

MANY FLOCKS OF SNOW-WHITE SHEEP

When 400 yards away from the nearest flock, a little blind was made by cutting out brush in the edge of a thicket on the top of a mound, and there we went into concealment for a number of hours. All the sheep were gradually working down wind, and the prospects for pictures and of determining their scenting power became excellent.

The nearest flock, when 300 yards away, began showing some uneasiness. The old ewe in front, and which had charge of this particular flock, several times raised her head, sniffing the air suspiciously. At 200 yards the leading ewe stopped, looked directly our way, and I felt sure the limit of the approach had been reached, so several pictures were taken of the band.

And none too soon, for the leader then turned back, and in a stiff-legged and peculiar way strode through the flock, with her little lamb following obediently in the rear.

All the other sheep, some of which were grazing and some lying down, seemed to take immediate notice of what was going on, for when the old ewe reached the end of the flock and began ascending the steep slope instead of continuing up the valley meadow, the rest fell in behind and in a few minutes a great long file was zigzagging up the side of the mountain.

And here occurred another striking result. Four large rams that had been reclining on the top of a flat rock 200 yards beyond the rest of the sheep all stood up and began looking about, first at the line of sheep ascending the mountain and then down the valley. Whether their restlessness was wholly due to the flock of sheep leaving the valley at that hour or to the manner or peculiar actions of the ewe or whether they had gotten a trace of scent was hard to tell.

Soon the other sheep began working away from us, finally dropping into a meadow walled in by a stone ridge running across the head of the valley except where broken by a narrow opening, through which a little stream dashed in a series of cascades.

During this and all successive days we saw none of the sheep drink water either from the streams along which they grazed or from any of the pools of water in the green meadows. Whenever the sheep became thirsty they always went to a snow field, and so noticeable was this that I spent a part of one day getting into a position where photographs could be taken of sheep coming to the snow banks for that purpose (see pages 484 and 487).

A little later I saw a band of about 20 sheep coming down the side of a distant mountain toward the meadow and on the dead run, jumping rocks, slipping and sliding down the steep sides of the bare mountain, hurrying across little terraces, over which they leaped and continued their rapid and downward course.

So striking was this sight and so certain was I that these sheep were badly alarmed that I aroused Tom, who was dozing in the sun a few feet away, and pointed to the sheep. Looking at them for a moment he said, "Why, those fellows are just coming to the meadow for their afternoon meal, and seeing all the others at work are losing no time in doing it."

"Just watch them," he continued, "and you will see that on reaching the bottom of the hill they will begin butting one another and cutting up all kinds of capers" (see picture, page 478).

And that is exactly what happened, for on coming to the edge of the little creek butting matches began, while some of the lambs jumped entirely over their mothers. At the creek it was a pretty sight to see them leap from bank to midstream, where rocks amid swirling waters gave a footing, and thence again to the opposite shore.

But the bunch of sheep which had come down the mountain in such haste either saw or smelled me when I photographed them, and immediately departed by the same route they had come. Also every sheep in the meadow behind the stone ridge left immediately for the mountain top.

I was curious now to know just how this little meadow looked, so we walked up and crossed over the top, looking down into a beautiful spot. Below was a circular meadow, containing a small but beautifully clear pond, and the trampled condition showed that every day the sheep came there for grass, which was unusually green and abundant. Whether at one corner of the pond a good-sized mud hole indicated the presence of a lick I could not tell at the time and was sorry not to have investigated it later.

This seemed an ideal place for close-range pictures, so we immediately began the construction of a blind on the face of the cliff, looking down upon the meadow. A narrow ledge allowed the piling up of flat stones until there was room for three of us to squeeze in behind and point the camera downward. We then left, but returned the following day. The experiences of our day in the blind are given in the following extracts from my notebook:

A MORNING IN THE SHEEP-BLIND

"*August 12—Ther., 75-52.*

"Today was selected for a visit to the stone blind above the little basin meadow, regardless of wind or weather. The three of us had spent a rather uncomfortable night in the small tent, and at an early hour I heard the men breaking the stunted willows for a fire and a cup of hot coffee. But the fog for the first time had descended into the valley and no object could be seen more than 50 yards away. This resulted in a later start and in the end proved a mistake.

"When half a mile below the blind, the fog lifted suddenly and the warm, bright sunlight illuminated the valley and the mountain sides in a way to accentuate the heretofore restricted vision of man or beast.

"Above us on the left, near the summit of the mountain, was a band of about 40 ewes and lambs, all lying down, but evidently looking at us. Two hundred yards above the blind, and on the same side as the others, were two big rams a little distance apart. One was watching us most intently, and in a moment began the ascent, while the other, apparently alarmed at his companion going up instead of down at the feeding hour, began to scan the bottom, where he soon saw us, though standing motionless. Instead of retreating he walked to the edge of a cliff and, standing like a marble image, gazed in our direction.

"Soon our positions became irksome and we started for the blind, while the ram immediately trailed after his more cautious companion and disappeared over the mountain top. Had we arrived an hour sooner none of these sheep would have been disturbed and, in addition to getting their pictures in the little meadow, probably others would have been attracted from more distant points. Entering the blind, everything was soon ready for an instant or continuous bombardment. But an hour passed and nothing came down any of the many runways, radiating like gray ribbons from the green meadow.

"Finally Tom, who thought that the big flock of ewes was past due, climbed cautiously to the top of the cliff behind the blind, and on his return said that not a single sheep was in sight. Among this flock were many that had seen us slipping up the valley, besides having additional warning in the hasty departure of the rams. This inferential power of sheep is remarkable.

"The 'sure thing' counted upon, like most predetermined results, had missed a cog somewhere, and when noon ap-

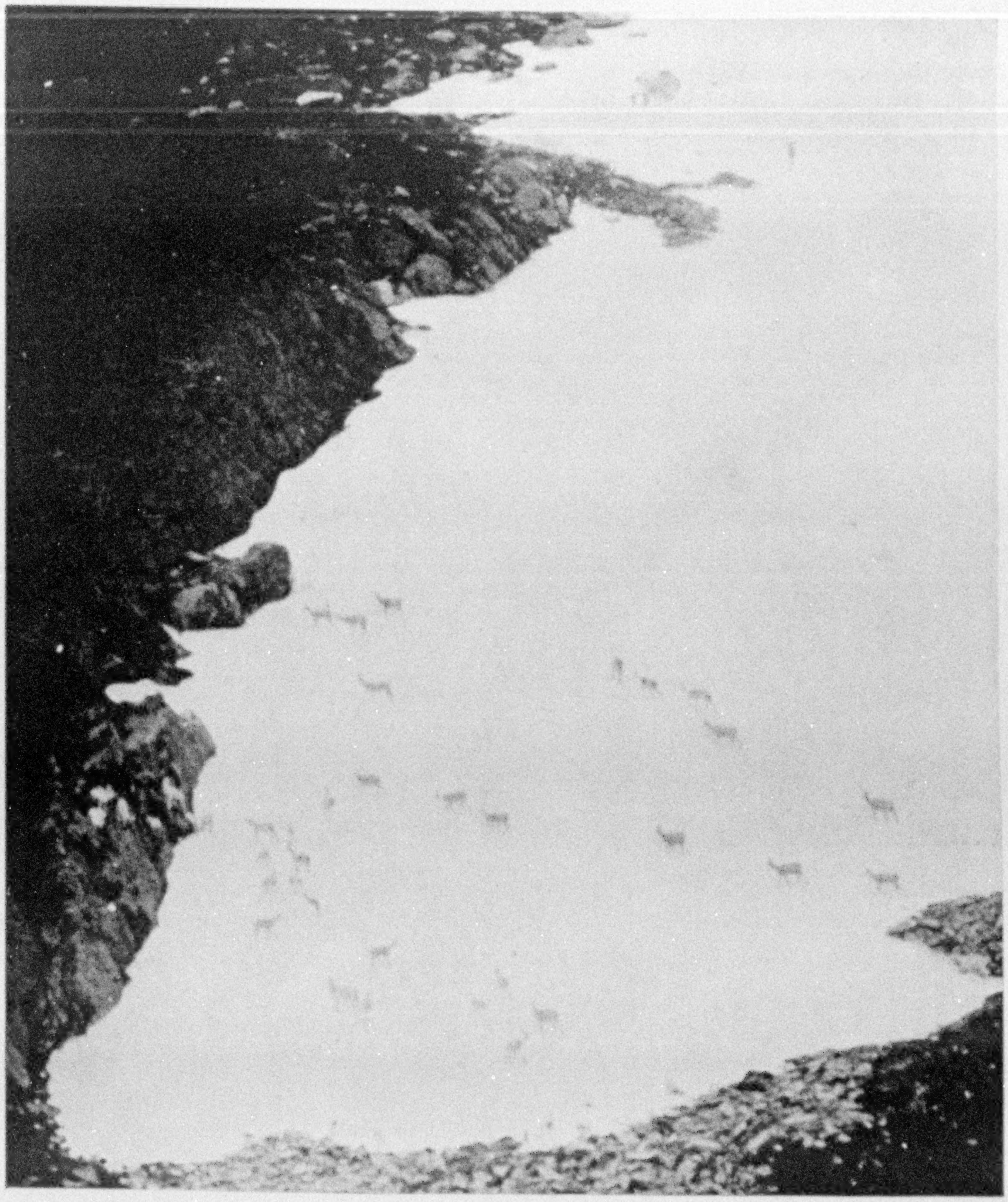

Photo by George Shiras, 3rd

A LARGE BAND OF SHEEP, NEAR THE MOUNTAIN TOP, CROSSING A SNOW FIELD FOR THE PURPOSE OF CLIMBING THE ADJOINING CLIFFS FOR THE NIGHT

proached the principal object of interest was the lunch-box. Finally, four sheep were seen on the skyline two miles away, and down they started on one of the big runways leading to the valley. They came rapidly and were soon standing on a bare plateau a quarter of a mile above the meadow. Here they stopped and looked below, but in a few minutes began grazing on the sparse grass. After remaining half an hour they took a trail toward the head of the valley, where there were doubtless a good many other sheep.

"It was then that the idea suggested itself of a light and portable set of life-sized profile decoys, made of white cloth, which could be set at any angle and where they could be seen broadside at a long distance. The day before, as al-

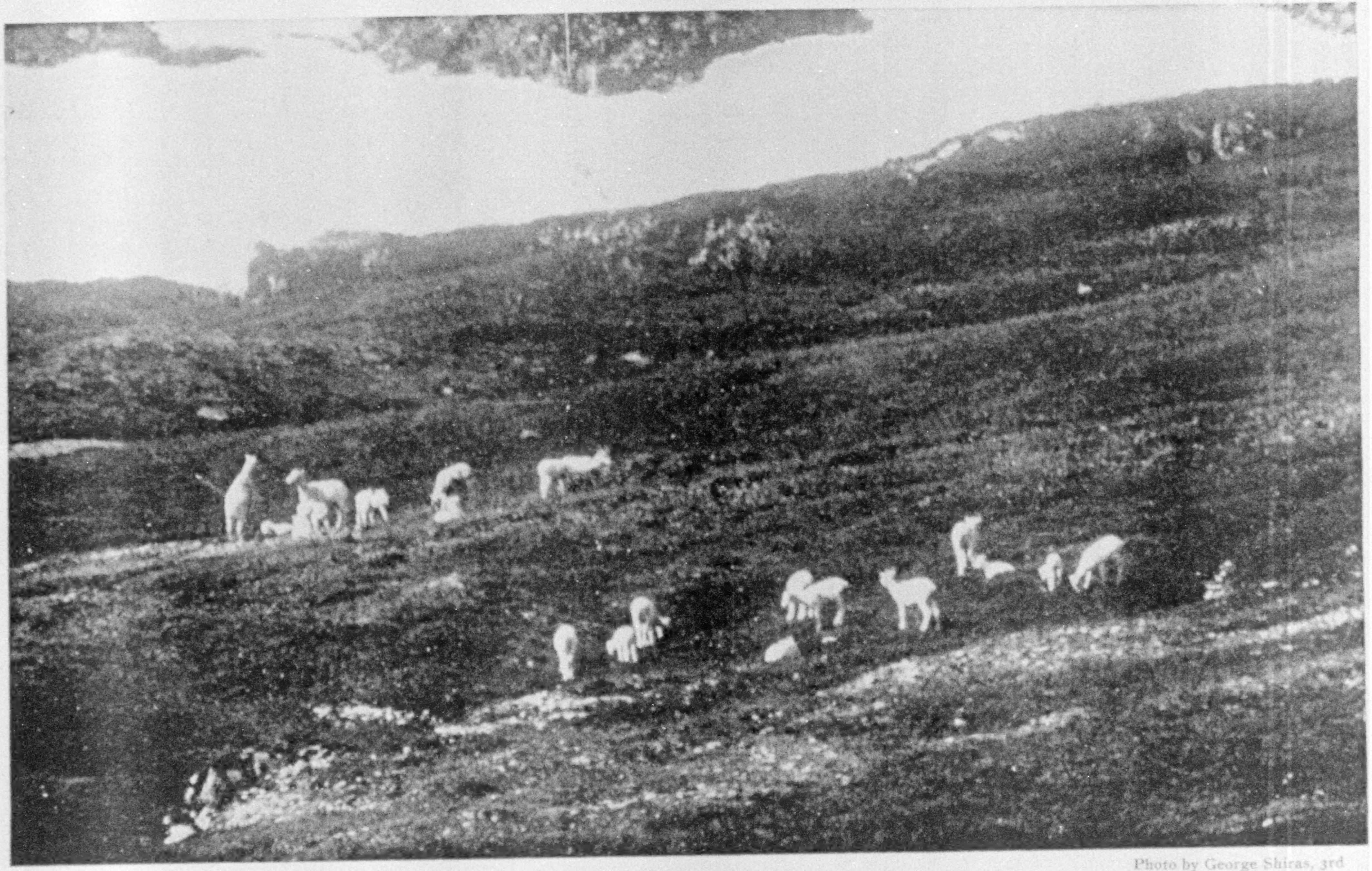

Photo by George Shiras, 3rd

A HIGH MEADOW STILL COVERED WITH MUCH SNOW: THE TWO EWES ON THE LEFT ARE HAVING A DISAGREEMENT OVER FOUR OR FIVE LAMBS THAT ARE PLAYING TOGETHER ready stated, we noticed how quickly and unsuspiciously small and scattered bands of sheep descended and joined flocks already feeding in the valley.

HOW THE BIG RAM WAS PHOTOGRAPHED

"At noon the lunch-box was opened, but before we had fairly made a start I saw a big ram approaching along a ridge from the direction of our camp. He came rapidly, with head up and mincing steps, looking very much like a small and sturdy caribou stag. When in sight of the meadow he stopped and looked down for fully five minutes, occasionally scanning the mountains on our side.

"We feared that, like the others, he would turn away at the sight of the deserted meadow. Tom, however, thought that the ram was most anxious to join a band of his fellows and might cross to our side in order to look for such beyond. At any rate he soon started down toward the creek and we were in doubt as to his final destination. At the edge of the bank he disappeared, and we then felt sure he would come along our ridge, but on which side was the question.

"Several moments passed, and I feared he was then passing behind the blind, cut off by a wall of rock against which our backs were resting. Slipping the strap over my neck, which supported the heavy camera, I was just in the act of climbing over the top of the blind when Tom seized my arm, whispering: 'Good Lord, here he comes right at us.'

"And there, stalking along most unconcernedly, was the ram, not 40 yards away, and, if not interrupted, would soon be gazing down into the blind.

"The several portholes made for the camera all faced the meadow, for an invasion from any other quarter had not been looked for. When he got within 75 feet I was in a quandary. To rise up nearly full length above the low wall of the blind meant his instant alarm, with no time to obtain the sharp focus necessary with such a big lens.

"Holding my fire, I trusted to fate. At 50 feet he stopped, turned broadside, and nibbled at a sprig of vegetation. Silently and quickly, in one steady motion, I arose, with my eyes fixed on the focusing mirror instead of looking at the ram directly. On the ground glass I saw his head raised suddenly and turned my way. Quickly the milled head of the focusing screw brought him in focus and the focal-plane shutter clanged harshly.

"But his white form had vanished when I raised my head, and, to Tom's and Charlie's inquiring glances, I could only say that the effort was successful, provided the ram was not in air when the shutter revolved."

It was two days before I went to Tom's cabin, and when darkness begrudgingly came at 10 p. m. I dropped the negative into the developer and in a few minutes saw on the plate the big ram, broadside, head up, gazing at the camera (see page 492).

PECULIARITIES OF THE SHEEP

The next and final day at the head of Benjamin Creek was reserved for studying and photographing a large flock of sheep, heretofore occupying the end of a ridge west of our tent and which always fed on a large circular meadow, nearly surrounded by small canyons.

At no time did the daily program vary. By 7 o'clock the entire flock of about 50 descended the mountain, crossed a little creek, and then in bunches of six to a dozen scattered out over the meadow, feeding not only on grass, but small bushes. Quite often some of these bands, containing many lambs, would work their way out to the edge of the meadow, fully three-quarters of a mile from the base of the mountains, so that their retreat could readily be cut off by the intervention of a man with a rifle or by any fleet-footed predaceous animal. This, of course, meant an entire absence of molestation during the season and probably for years.

In the daily movement of the sheep on the steeper mountains I noticed that in coming down they usually took an earth trail, however loose the soil or treacherous the shaly rocks. On their return the steepest cliffs, if affording a good foothold, were ascended in preference to the near-by trails used on their descent.

The probable reasons, if my brief observations warrant an opinion, were

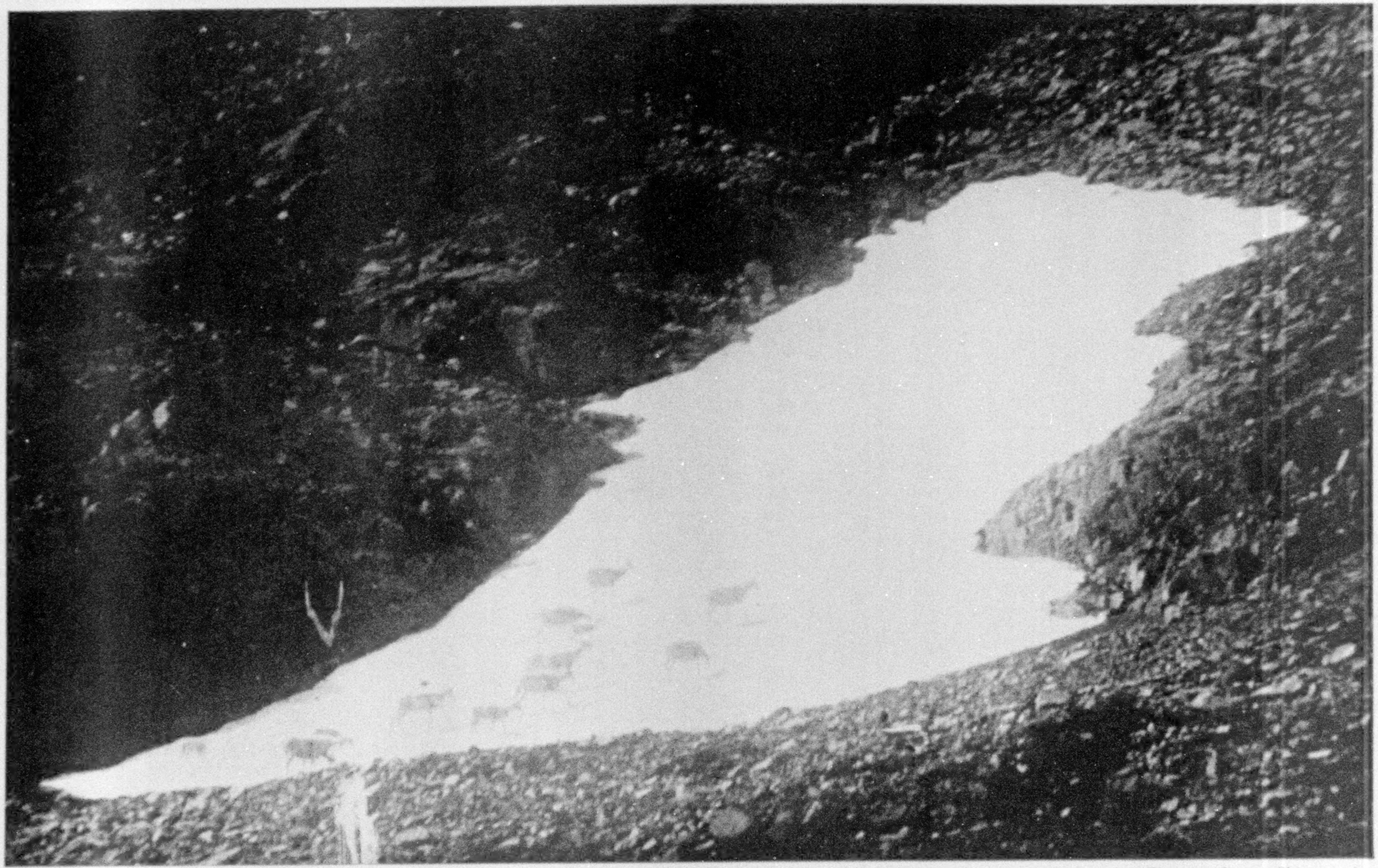

Photo by George Shiras, 3rd

SHEEP THAT HAVE SPENT THE ENTIRE AFTERNOON ON A MEADOW WELL SUPPLIED WITH WATER, WHICH THEY REFUSED TO DRINK, NOW QUENCHING THEIR THIRST ON SNOW

Life on the high mountains, where most of the year there is no water, and what there is in the summer swiftly cascades from the snow fields, seems to have made them dependent on snow instead of water

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these: (*a*) On the descent the loose soil and tumbling rocks accelerated instead of retarded the progress of these surefooted animals, while returning such conditions had the opposite effect, and (*b*) in the jumping down from ledge to ledge of animals weighing from 100 to 250 pounds, a slip or the breaking of the ledge was much more likely than when ascending a cliff, because each upward jump was made with the lightness and accuracy of a bird.

I had noticed, moreover, that at noon some of the sheep often returned for a rest on a lower slope of the ridge. There was no way of making a blind on the meadow without alarming them all, except during the night, and this would have been a difficult undertaking, so I planned getting on the ridge during the morning and after all the sheep had gone to the meadow, when there would be a chance for pictures in case any returned at noon and, with a greater certainty, as they assembled toward night in the vicinity of the blind.

After breaking camp in the morning, Charlie continued on down the valley with his pack to the cabin, while Tom and I left ours near the pond, where we intended wading the outlet stream, so as to reach the base of the ridge at a point where nothing could see us from the meadow. This stream proved much deeper and swifter than it looked at a distance. While not objecting to a wetting, we feared being carried off our feet, with the resultant injury or loss of the photographic outfit. It is in just such cases that a rifle will stand much more ill-usage than a camera. Nearly an hour was spent gathering and throwing flat stones into the swift water until a secure footing was obtained.

On reaching the edge of the ridge, at a point about 200 feet above the meadow, we could see many scattered bands of sheep; but, to our disappointment, a dozen sheep were now coming along in single file toward the ridge, and were then too close for us to pass around and get in a position to meet them on their ascent, so there was nothing to do but to await developments.

In a few minutes they had jumped the creek, one lamb falling over backward into the water, much to the indignation of its mother, who stamped her feet vigorously as her bedraggled offspring endeavored to climb the steep bank. With a single and later exception, this was the only time any sheep, big or little, proved awkward or careless.

PHOTOGRAPHING THE SENTINEL EWE

When the band finally came up the slope they were soon lost to sight and we waited until they had time to reach a resting place. On climbing to the rim I saw the flock about 200 yards to the left and on the same level. All were lying down but one, evidently the sentinel.

After carefully studying the approach and figuring on the possibilities of remaining concealed, Tom assured me "that with ordinary crawling agility one could get within 50 feet." But as Tom could crawl like a serpent, climb like a squirrel, and had the equipoise and jumping ability of an ibex, his encouragement was of a doubtful character.

Experience had taught me, however, that while it was important not to be seen approaching, it was equally important, when armed with a camera, to know the exact position of the animals in relation to the last cover sought.

Having determined this I started on all fours, a mode of travel rendered more difficult by being compelled to push the heavy camera ahead. When the final rock was reached, I very slowly pushed a piece of small brush to the top of the rock and then raising my head looked through it. This method, if observed by animals near at hand, might excite a puzzled interest, but even so is safer than the appearance of a human head a few yards away.

The sheep were lying in a row, less than 20 yards off, and the sentinel ewe was standing, with a little lamb at her feet, while to the right was a large ewe lying down and the rest near by. I could see that it was impossible for the plate to cover them all and be in proper focus. Then came the idea of getting the sentinel ewe and lamb, thus supplementing the picture of the big ram and completing the family group. In a moment the camera was arranged and at a focus probably requiring no further change when brought to bear upon the sheep.

Lowering my eyes into the hood surrounding the focusing mirror, I slowly arose, and when the camera cleared the top of the rock I found the sentinel looking directly at me and in sharp focus; so, without a moment's hesitation, the button was pressed and the shutter revolved. What the camera saw is now reproduced on page 490.

Before the frightened sheep had a chance to gather their wits I had reversed the plate-holder and caught the band as they struggled in a disordered way over the broken rocks above me (see photograph, page 491).

We then set about constructing a comfortable blind between rocks concealing us from animals coming from below or above, and where we could remain the rest of the day watching the scattered bands of sheep on the meadow below. It seemed that practically every such band had a leader, and in moving from one locality to another or when feeding, one could readily pick it out. And this, today, is the surviving and predominating characteristic of domestic sheep. A dread, growing out of their exposed position and distance from the mountain, was noticeable, too, and manifested by the way the sentinel sheep continuously surveyed the country (see page 489).

And here there may be interposed some general observations on the above subject. Mr. Charles Sheldon, who is accepted, and properly so, as the leading authority on northern sheep, inclines strongly to the belief that such bands of sheep have no sentinel in a strict sense, but rather that the more alert or experienced of the members at times give the appearance of prearrangement for guard duty. Such a conclusion is undoubtedly true of caribou and elk, but in the case of sheep, where gregarious ties are very strong, it seems to me that the assumption or selection of a leader, covering days and perhaps seasons, means the necessary assumption of lookout duties, unless such a leader is thoroughly satisfied that every condition is favorable to the security of the flock (see pictures, pages 489, 490).

During my observations Tom was devoting himself to watching the mountains above, where he finally discovered a ewe coming down towards us, and which he thought was one of the sheep that might not have seen us clearly when the stampede took place and was anxious now to join the other sheep feeding in the meadows. Its course would bring it some 20 yards to the left and well out of way of the quartering wind blowing up the side of the mountain.

At 75 feet the sheep turned to the right, and, as we knew that the wind would bring it across the line of our scent, I was most anxious to note the results, even if I lost the picture. When between two rocks, with only the head and shoulders showing, the scent struck it suddenly. The animal winced as if shot and dashed upward again with the speed of a deer.

This showed pretty conclusively that a sheep at close range had a good nose, at least when previously alarmed.

Finally the animals on the meadow turned toward us, and we thought that the time had now come for a series of pictures, as band after band came up our side of the hill.

The leader of the first flock began watching the side of the mountain, coming 10 or 15 feet and then stopping for a minute or two, during which intervals the rest of the band continued to graze and often laid down. On reaching the creek the leader had apparently become very suspicious for some reason, and stood eyeing the entire side of the mountain, but finally lay down with the others, but with head turned toward the mountain side. Unquestionably the absence of sheep where they were accustomed to gather in the afternoon, and possibly the ascent of the first flock, had something to do with the uncertainty of the leader.

Meanwhile another band had come within 50 yards of the others, also led by a ewe, which acted very much like the first. In a few minutes the two bunches commingled, and, to our regret, soon began retreating towards the meadow, where they stood in an uncertain kind of way for a long time. Then the two bands separated, one continuing up the little creek. The manner of the leader, look-

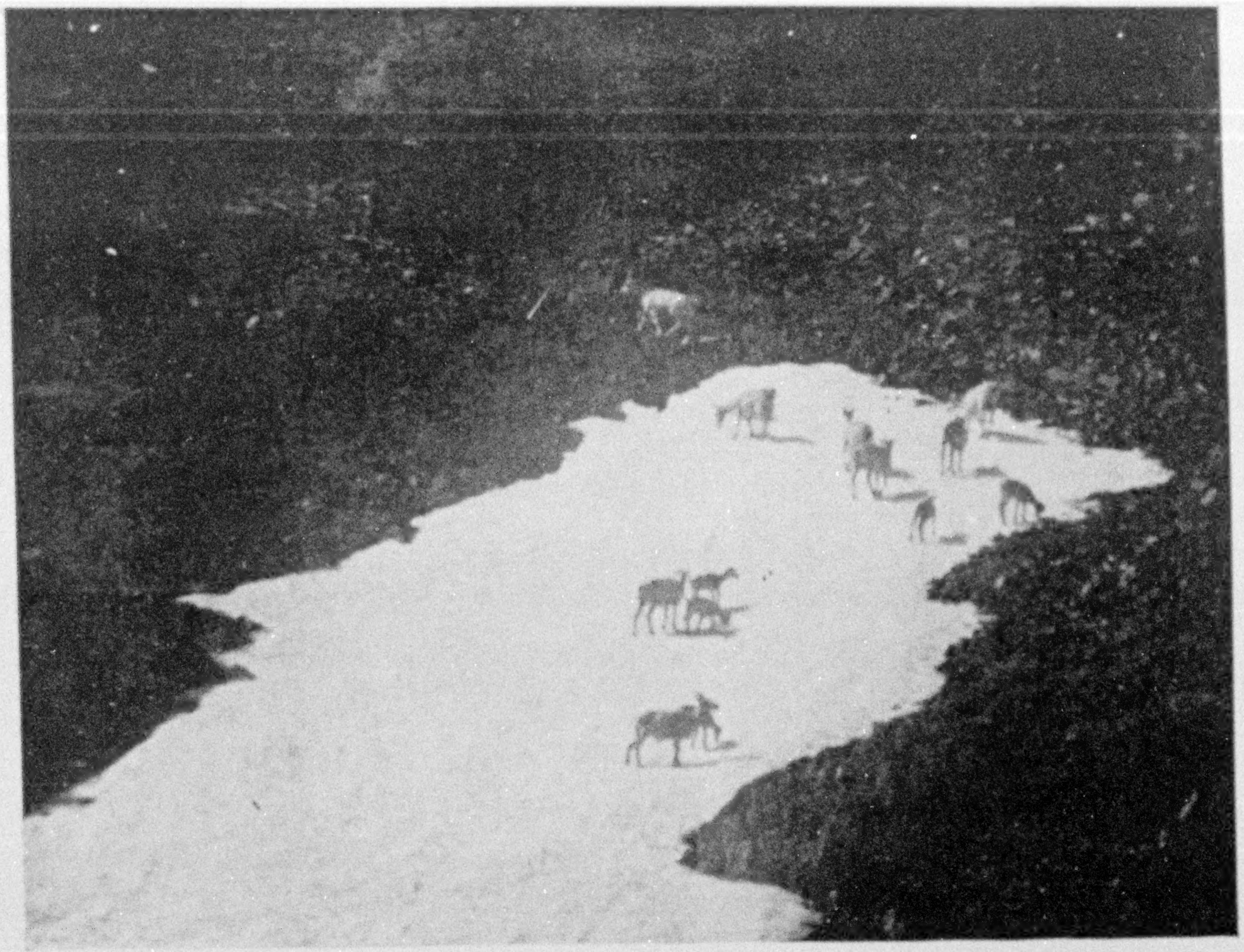

Photo by George Shiras, 3rd

THE SAME BAND OF SHEEP AS SHOWN IN THE PRECEDING PICTURE, STILL EATING SNOW: PHOTOGRAPHED IN THEIR OWN SHADOWS, THEY APPEAR UNUSUALLY CONSPICUOUS ON THE SNOW

ing steadily at a distant point on the side of the mountain, led me to turn the glass in that direction, where I saw four sheep on the edge of a cliff, and towards which the band was evidently going. Soon the others were on the move across the meadows, all headed, with the exception of one distant flock, for the same spot, and we saw our chances fading away. In a short time these flocks had joined the four at the other end of the ridge, a portion doubtless of the flock which we had previously photographed, and which had sought out a new place for the night.

At 4 o'clock the little band of sheep that had been fading at the extreme western end of the meadow came trotting back on a well-defined trail bordering a canyon, and I felt almost certain that none of these sheep would come to our blind, although on five previous days all the sheep had gathered every afternoon just above it. Now, more than ever, I was convinced that a set of sheep decoys, as suggested previously, would have brought most of these sheep within photographing range. Tom even thought that a white linen night-shirt would have answered if he could have been permitted to trot about in it in front of the blind.

As the last flock continued to approach it seemed best to slip down the side of the slope as close to the creek as possible and try for a picture as they went by. When a third of the way down I found they were coming more rapidly than expected, and, in an effort to pass an exposed place between two rocks—and which should have been done by crawling very slowly—I carelessly jumped across, and in landing behind the sheltering rock I heard Tom's warning whistle.

Looking down on the meadow, I saw that all the sheep had reversed ends and were rushing back again. Since these animals were more than a quarter of a mile

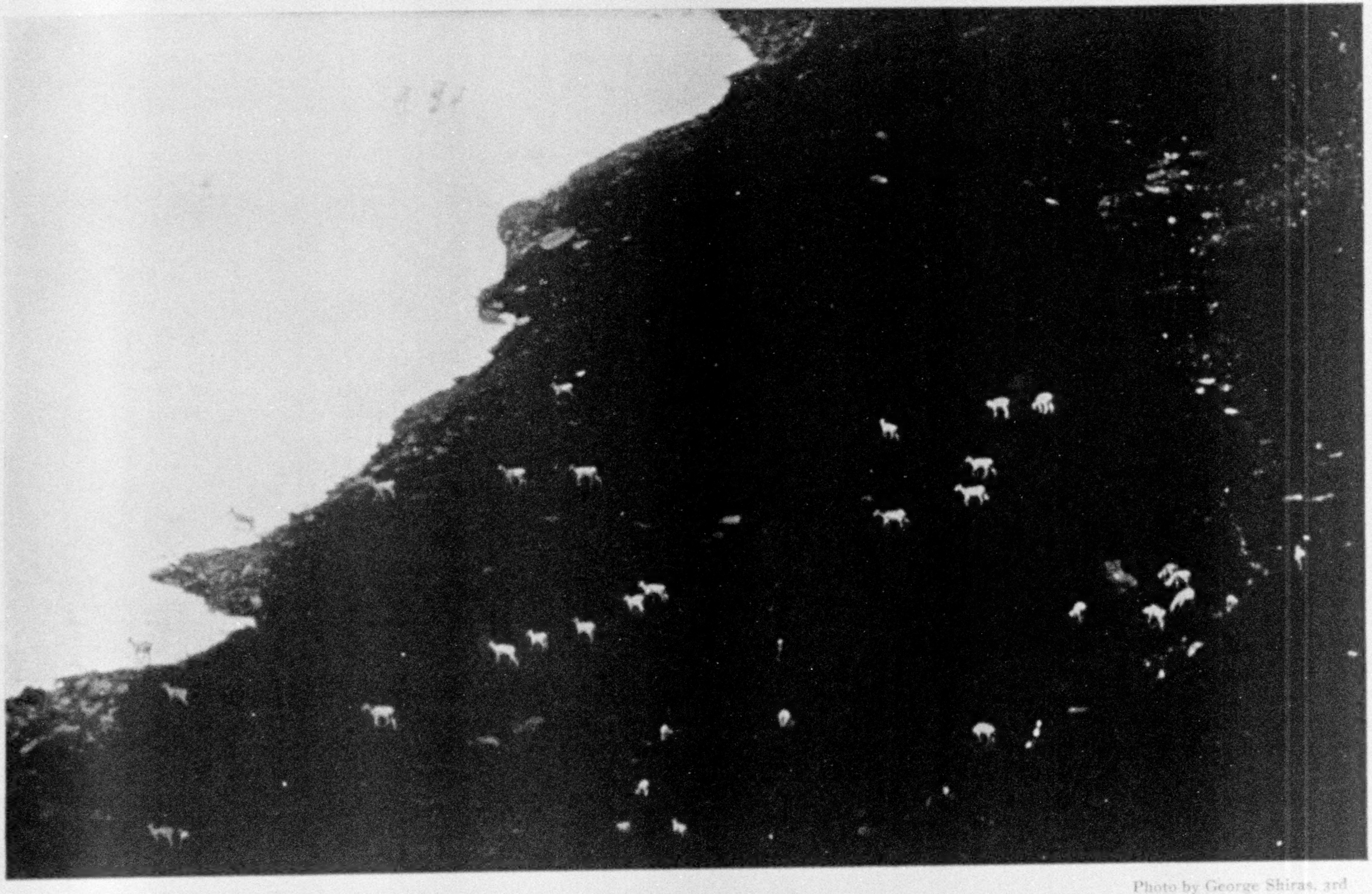

Photo by George Shiras, 3rd

SHEEP TRAVELING TOWARD THE LARGEST SNOW FIELD IN THE VICINITY

Note the four big rams on the upper edge, and how inconspicuous when compared with the smaller sheep on the dark soil. The curved and bulky horns of the four rams can be clearly seen. The rams spend most of the summer on the extreme mountain tops, rarely accompanying the ewes at this season.

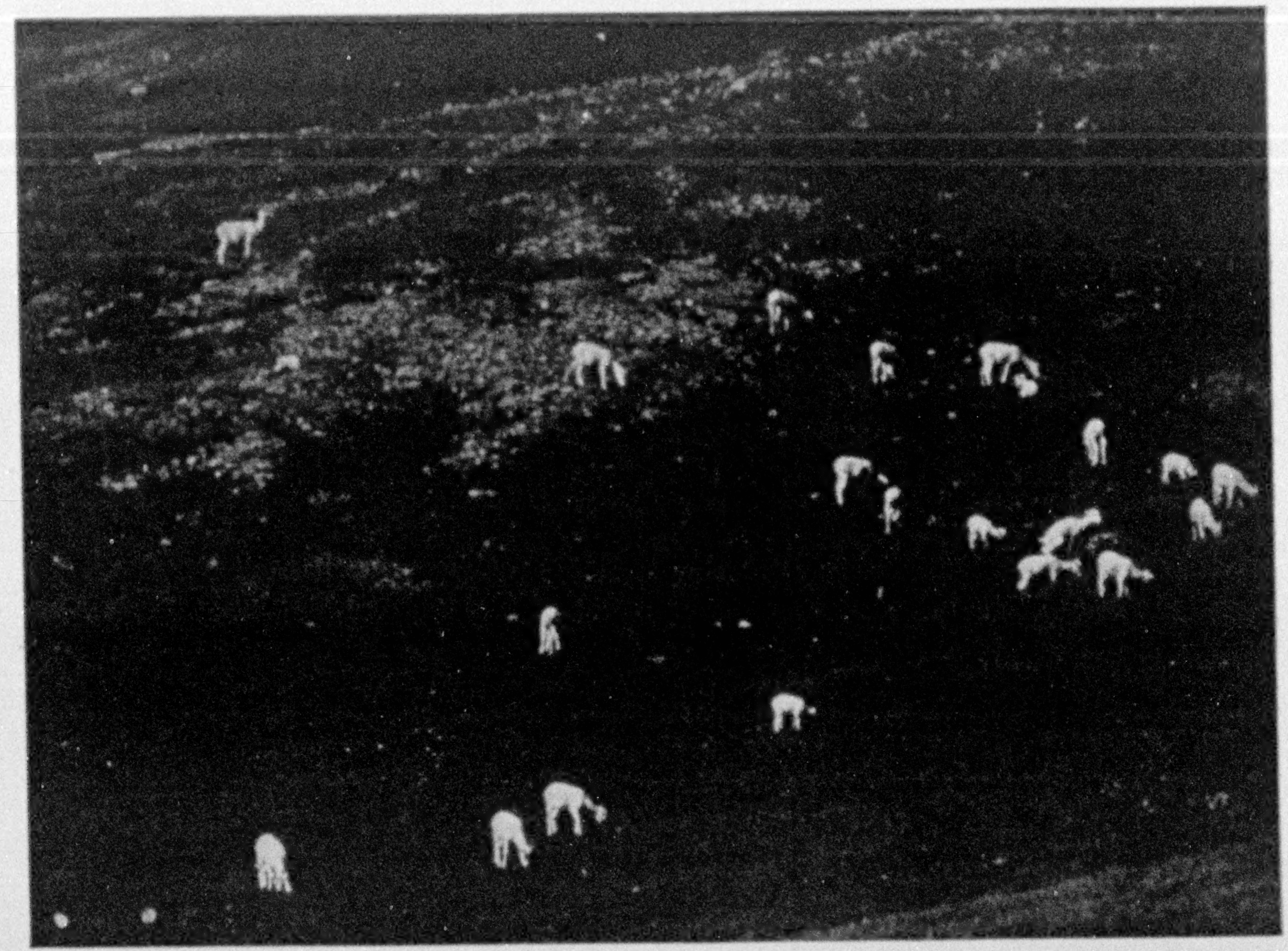

Photo by George Shiras, 3rd

THESE SHEEP FED FOR HOURS WITHOUT LOOKING ABOUT, EXCEPT THE SENTINEL ABOVE, ON THE LEFT (SEE PAGE 486)

The keen vision of these sheep is practically their sole reliance for detecting danger. They always feed or rest on open ridges or hillsides devoid of bushes, from which they can have an unhampered view in every direction. They also possess unusual power of inference, detecting danger from the actions of other sheep, however distant the latter may be.

away, it was a good illustration of their acuteness of sight and their quickness in realizing the character of the danger. Not knowing how these sheep could escape in the direction they were going, I called to Tom for advice. He yelled that they were now headed for an ice-bridge across the canyon (which I did not know of), and, after crossing this, he thought they would swing around our way again for the purpose of ascending the mountain slope just behind, and that if I hurried there would be a chance for a picture.

But after exercising all the energy at my command the sheep won, and I could see them 200 yards below quartering up the mountain. In a few minutes they reached a ledge of rock within a hundred feet of the crest of the great black cliff opposite the site of our former camp.

This was our last view of the white mountain sheep until two days later, when we entered the pass of the low divide above Skilak Lake.

Our visit had made the sheep considerably wilder, and the flocks which formerly rested each night on the lower benches now whitened the ledges of many a high cliff; but no red had dyed the white and woolly sides and no flock noticed an absent one within its ranks.

The next morning we left for Skilak Lake, camping a half mile this side of the low divide and giving the men a chance to make a second trip to the cabin that day.

OUR LAST VIEW OF THE WHITE SHEEP

At an early hour the next morning the little tent was taken down and cached with other articles, to be called for the following day, and then with heavy packs we began trudging along the slight rise to the low divide, through which

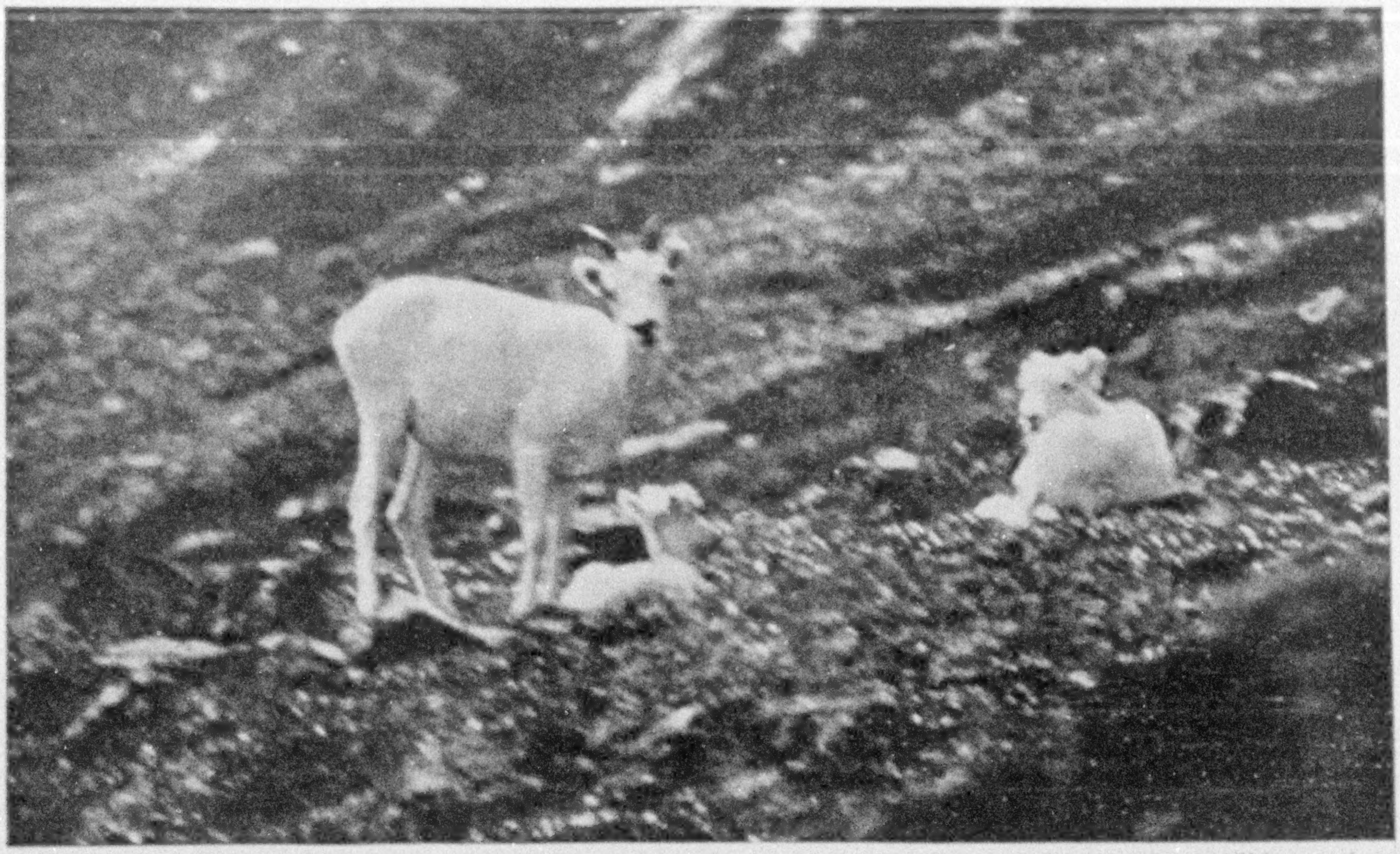

Photo by George Shiras, 3rd

THE SENTINEL EWE

After a long stalk on all fours the author got within 50 feet. Note the extremely long legs of the ewe. The short black horns and white body have led many of the Alaskan miners from the Rocky Mountain States to mistake the ewes of these sheep for white mountain goats (see pages 485 and 486).

Cottonwood Creek ran on its short and rapid career to Skilak Lake, 3,000 feet below.

It was here that I got my last photographs of rock ptarmigan, and as we climbed up on the broken mass of rock, littering the pass between the cliffs of the divide, I put away the lenses and boxed the camera in case of a fall through such insecure footing. Half way through the pass some one noticed seven or eight sheep, almost overhead, lying on a narrow ledge, with a perpendicular drop of nearly 300 feet below them. To those who have seen large, white gannets, nesting here and there upon the face of a maritime cliff, the resemblance was a striking one. Before I could get the camera out and arranged, the sheep, noticing that we had stopped and were gazing upward, became alarmed, and in a series of awe-inspiring leaps took ledge after ledge until the top was reached, when, getting in line, they all looked over. And that constituted my last but still lingering picture of these graceful creatures, poised on the highest summit above Skilak Lake.

Impressed once more with the agility and self-confidence of these nomads of the skies, I asked Tom whether he had ever seen the remains of any indicating that sometimes life paid the forfeit of a careless gambol or in the desperate effort to avoid pursuit. He replied that during nearly 16 years in the sheep ranges of Alaska he had never seen a single case of the kind, though several times having found carcasses at the foot of a snow avalanche.

And then occurred within a few short hours and at the same spot a tragedy constituting a most remarkable sequel to my inquiry.

After returning to the lake and remaining over night, Tom and Charlie started back in the morning for the tent and the remainder of our outfit. In passing through the same divide Tom saw, hanging partly over a ledge and midway between top and bottom, the crumpled body of a large, fine ewe, while running about below was a little lamb, which, whimpering and bleating, continued to look up toward the spot no feet could scale.

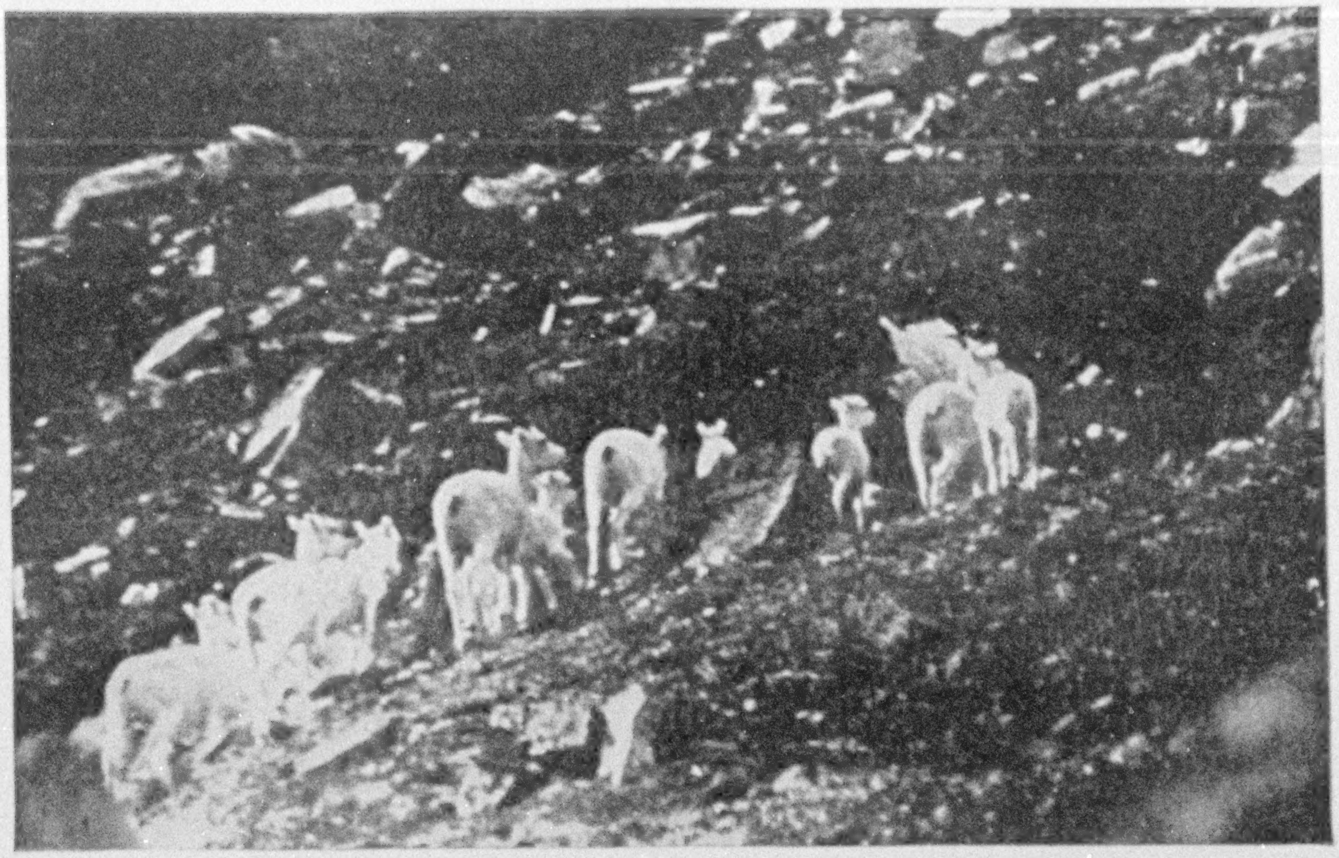

Photo by George Shiras, 3rd

BUNCH OF SHEEP, WHICH WERE BADLY FRIGHTENED WHEN PHOTOGRAPHED, RUNNING UP A ROUGH MOUNTAIN (SEE PAGE 486)

How this accident happened is, of course, a matter of surmise; but not unlikely the mother had rushed in between her young and the edge of the great cliff as it gamboled recklessly near, and slipping over left her offspring wondering at the audacity of the leap. But be this as it may, we know that when time passed and the mother failed to return the little fellow by a circuitous trail reached the bottom of the pass, to be no nearer than before to the only one it loved.

Let us trust that before the long hours of the summer day had passed the little lamb saw a white line zigzagging into the valley, which he dimly knew was the pastoral range of his mother's clan, and approaching found a welcome within the ranks, and no less so because he came alone.

SUMMARY OF GAME CONDITIONS ON THE PENINSULA

On our return from the mountain country the camp was located at the further end of Caribou Island, a few miles west of Double-bay camp, and opposite the moose lick.

This island is about three-quarters of a mile long, with a maximum width of a third, and, excepting a few acres of pine, is covered with a vigorous second growth and some swamp land, the result, probably, of the same fire which cleared so much of the shore opposite.

And here it may be remarked that, however wasteful in a commercial sense may have been many of the forest fires in the wilder portions of our continent, they nevertheless have often been of corresponding benefit to the game and range stock. The replacement of dense and often stunted and useless conifers with poplar, birch, cherry, oak, beech, maple, and the subsequent appearance, also, of meadows and glades covered with grass, moss, bushes, and small herbage, has done much in the way of supplying an abundant and nutritious variety of winter and summer food, valuable alike to the larger game animals, domestic stock, pack horses, many game birds, and small quadrupeds, few of which resort to or can thrive throughout the year in the dense, dark evergreens of the North.

In recent years hundreds of thousands of acres of such second growth have sprung up in Alaska, and nowhere has it been of greater advantage to game and

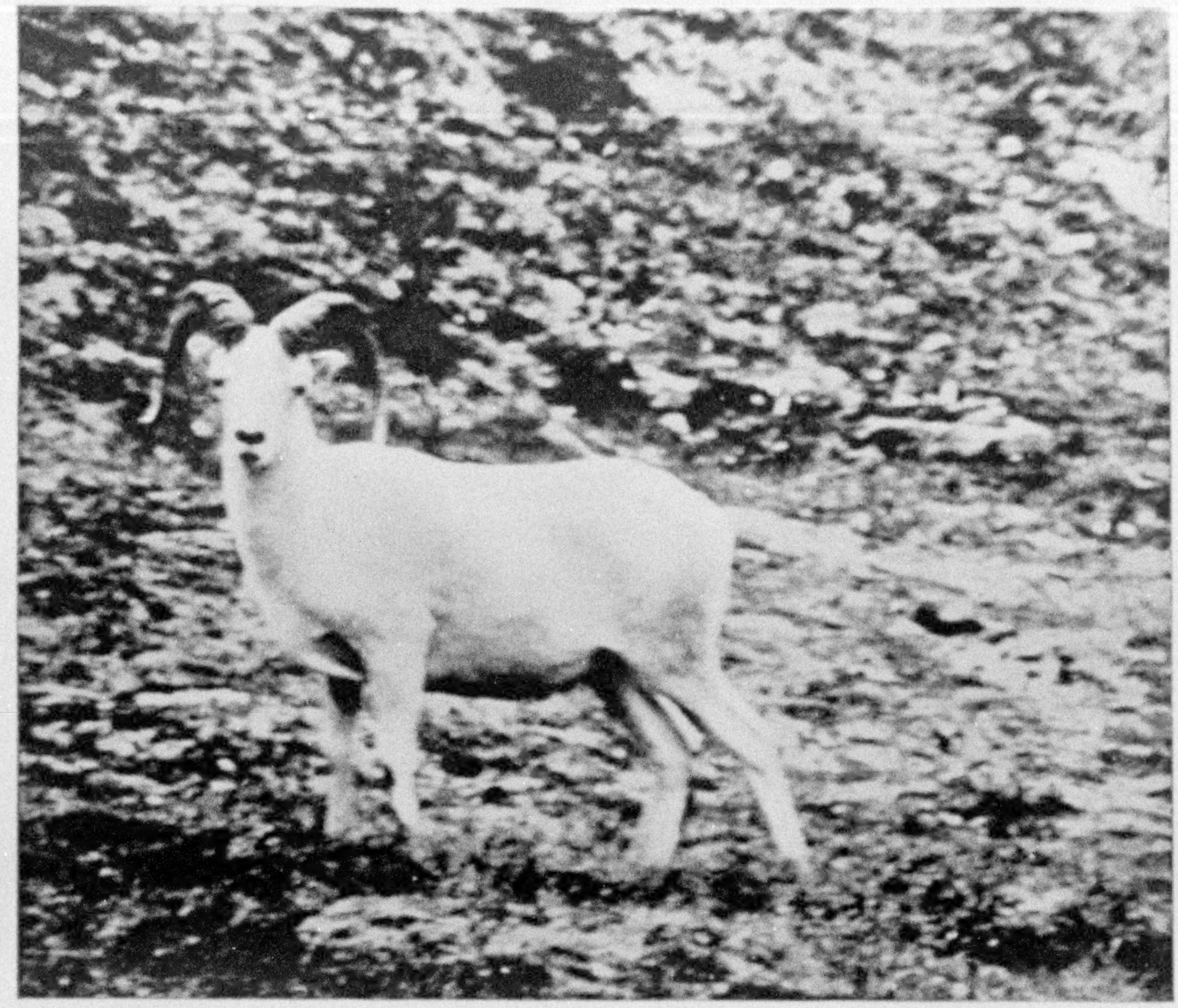

Photo by George Shiras, 3rd

A BIG RAM PHOTOGRAPHED AT 50 FEET FROM AMBUSH

He jumped the instant after the shutter revolved, but left his picture behind him (see page 483). Note the fine and graceful horns

the pack trains than throughout the interior of the Kenai Peninsula. Caribou Island, subjected to easy examination, showed that on the coming of the ice it was visited by many moose, while the abundance of spruce partridges indicated their appreciation of the berries and swelling buds, just as the rabbits thrived on the tender bark and great variety of smaller plants.

In its isolation the Kenai Peninsula is a great Presque Isle, allowing a marked segregation of northern game, favorable alike to their previous existence and now much improved by physical changes, the ease with which the game laws can be enforced, the concentration of Indian settlements near the canneries, and the practical extermination of the wolf.

Reports of those best acquainted with present conditions show that the moose have been increasing steadily in recent years, that the white sheep are thriving, and all other game animals except the small fur-bearers and the caribou are holding their own. Just why the caribou has approached extinction no one seems to know, but I am glad to report that a good-sized stag was seen south of Benjamin Creek by a party of surveyors during last July. As much of the peninsula is well adapted for caribou or their near relatives, the Siberian reindeer, an effort should be made for their introduction, since the interior will readily support a herd of many thousands. As they feed upon a form of ground vegetation now going largely to waste, their presence will not prove a detriment to the other game animals, but on the contrary will afford

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an additional supply of meat for visitors and natives, besides largely decreasing the drain upon the moose and sheep.

On several occasions it has been suggested that the peninsula was just the place to establish a national park, but its remoteness and the need of developing such resorts nearer home make such a plan impracticable at the present time. Neither should this country be set aside as a permanent game refuge, because the narrow base connecting it with the main shore is traversed by a great glacier, practically cutting off the egress of the animals, and it thus lacks the essential prerequisite of every such refuge, where the surplus animals should have a chance to populate the surrounding territory.

The district, defined on the map facing page 428, is the most accessible and probably the most populated sheep range on the continent. Here on a few of the more northerly mountains I saw some 500 sheep, and here, too, is the summer range of many moose and the home of the great brown bear. In many other localities big game is plentiful, and it may prove on investigation that in the great stretch of unexplored mountains facing Prince William Sound there are white mountain goats and some specimens of the glacier bears.

THE GREAT ICE-CAP

The sheep country, between Skilak and Tustumena lakes, is walled in on the east by an immense ice field, the history of which has never been written, and only of late has its true character been determined. Marked on the older maps as the Kenai Glacier, it is in reality a great ice-cap, probably unsurpassed on the northern continent except by that of Greenland and the well-known Malaspina ice field at the base of Mount Saint Elias.

Unlike a true glacier—created by ice streams flowing from the higher lateral valleys—this great ridge of ice, towering 4,000 feet above the sea, fills the lower valleys with hundreds of glaciers, some of which are active and still topple great masses of ice into Resurrection Bay, while others are stationary, or receding, but contributing to the flow of nearly all the streams originating south of Skilak Lake.

No one has ever crossed it at the widest point, and no one has ever traveled its entire length. Computations from various sources show this ice field to be 70 miles in length with a maximum width of 20 miles.

Whether originally formed by local precipitation, now insufficient to maintain its present bulk, or whether this ice ridge is a great keel of a mighty ice field which once bore down upon the peninsula, is a problem for the geologist rather than the casual visitor.

The first week in August Skilak Lake suddenly rose a foot in a single night, and the only explanation was that the ice stream below the cap had become clogged for days and, when the pressure became too great, burst its bonds. The milky and turbid condition of the lake corroborated this view.

The weather conditions during the trip were most favorable for game, although we were undoubtedly fortunate in being there during an unusual season.

In 55 days rain fell during 19 hours—practically a drouth. We were windbound three days and experienced a number of violent squalls lasting an hour or so. There were three entirely cloudy days and half a dozen partly so. This resulted in unusually high water in all the mountain streams—an anomaly during dry weather further south, where rain and not melting snowbanks maintained the streams. As a secondary result the mosquitoes were scarce, with the swamps dry; but the black flies, beginning in September, were the worst I ever saw, nearly devouring the men alive as they toiled at the tracking line on the return up the Kenai River.

The maximum heat the last two weeks in July was 87°, on the 19th instant, and the minimum 40°, on the night of the 21st. The average maximum for that period was 70° and the average minimum 45°.5. In August the maximum was 83°, on the 7th instant, and the minimum 32°, on the night of the 10th. The average maximum for the month was 69°.2, and the average minimum 46°.5. The first

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week in September the maximum was 67°, on the 1st, and the minimum 28°, on the night of the 2d. Part of this time we were in the mountains, but the weather continued so warm that the altitude did not materially affect the average.

Undoubtedly we were in the most favored portion of the peninsula, and there during an unusual season besides. Often rain and fog encompassed the higher mountains, and frequently we could see storms moving up and down Cook Inlet. Moreover, the great mountain range on the east undoubtedly cleared the wind of moisture before reaching us.

Hunting parties coming out later reported bad weather during the last of September and in October, so the above data must be taken rather as an evidence of what the weather can be than what it is apt to be.

In the winter months the snow is not deep in this region, and for causes already suggested. Last winter, when the middle and easterly States were experiencing the severest weather in 40 years, it was unusually mild on the Kenai Peninsula, because during the fall and winter a continuance of southeasterly winds held the Japanese current close against the Alaskan shore, and at a time when the Arctic cold waves were sweeping over the central and Atlantic coast States. Whether these counter-currents were correlated or whether they were coincidental and of no significance is a matter for the expert meteorologist to investigate.

In conclusion, let us hope that those interested in the permanent prosperity of the Kenai Peninsula appreciate the value of an abundant and available supply of game-food animals and fish, and understand how much the presence of this game has contributed to its fame throughout the world.

The shipment each fall of thousands of pounds of moose and sheep meat from the Kenai Peninsula to the mining towns of Valdez and Cordova is only of a temporary and trifling benefit to a few market hunters, and will some day prove a costly loss.

Long after the last flake of gold has been panned from the sands and the last blast has fractured the veins of quartz, the Kenai Peninsula should continue to be the home of the giant moose and the place where the sheep, the grouse, and the salmon are worth more in dollars and more in life than all the visionary or fleeting fortunes beneath the soil.

AMERICA'S MOST VALUABLE FISHES

By Hugh M. Smith

United States Deputy Commissioner of Fisheries

THE answer to the question, What are the most important fishes in American waters? is likely to vary with the geographical distribution of the persons addressed.

The average citizen who lives within the sphere of influence of the sacred fish effigy hanging in the Massachusetts State-house will undoubtedly name the cod and its allies that frequent the inshore waters and the great submerged "banks" lying off the coasts of New England, the British maritime provinces, and Newfoundland.

From the Hudson to the St. Johns, a primary vote would probably favor the shad and herrings among river fishes, and the bluefish and squeteague among marine species.

Along the 1,700 miles of low-lying coast that extends from Key West to the Rio Grande, the fishermen and the fish-eating public can hardly conceive of anything more important in the way of food fish than the mullets and snappers.

Throughout the Great Lakes the whitefishes, trouts, and pike perches are so abundant and support such extensive fisheries that they would undoubtedly be awarded front rank by millions of people in the States abutting on these waters.

In the vast region drained by the Mis-

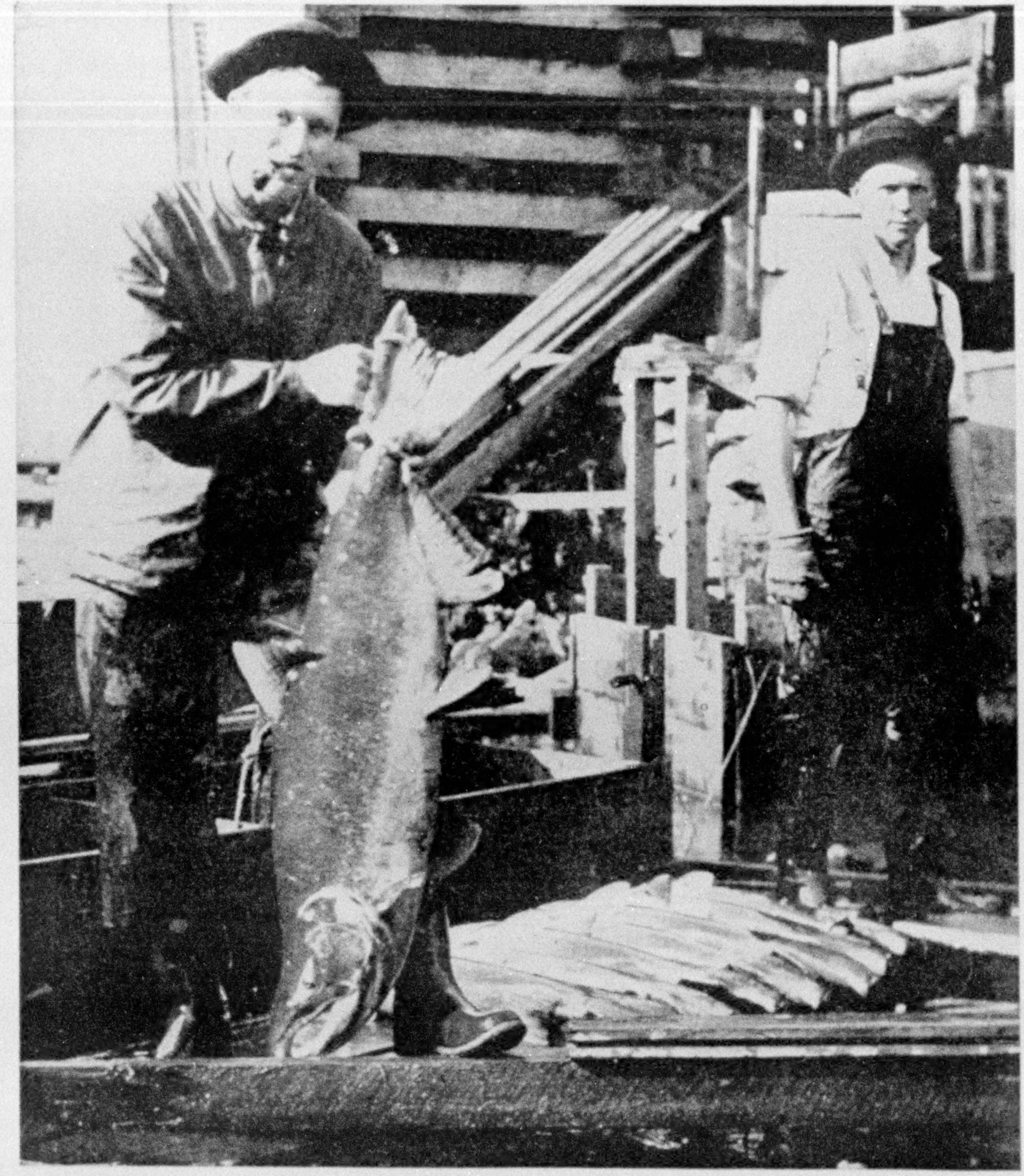


Photo by Shirley C. Hulse

AN UNUSUALLY FINE MALE CHINOOK SALMON: WEIGHT, PERHAPS 60 POUNDS. THIS IS THE MOST MAGNIFICENT OF ALL THE SALMONS

sissippi and its tributaries, such homely species as the catfishes and buffalo-fishes attain their greatest development, and originally contributed more than any others to the income of the fishermen and the food supply of a score of States; but these natives have now been supplanted by an Asiatic alien which, having received a course of cultivation in Germany, came to our shores because of inducements held out by our government, and now, under the inaccurate name of German carp, has become the most important inhabitant of our interior waters.

Finally, practically every person on the Pacific seaboard will, without hesitation

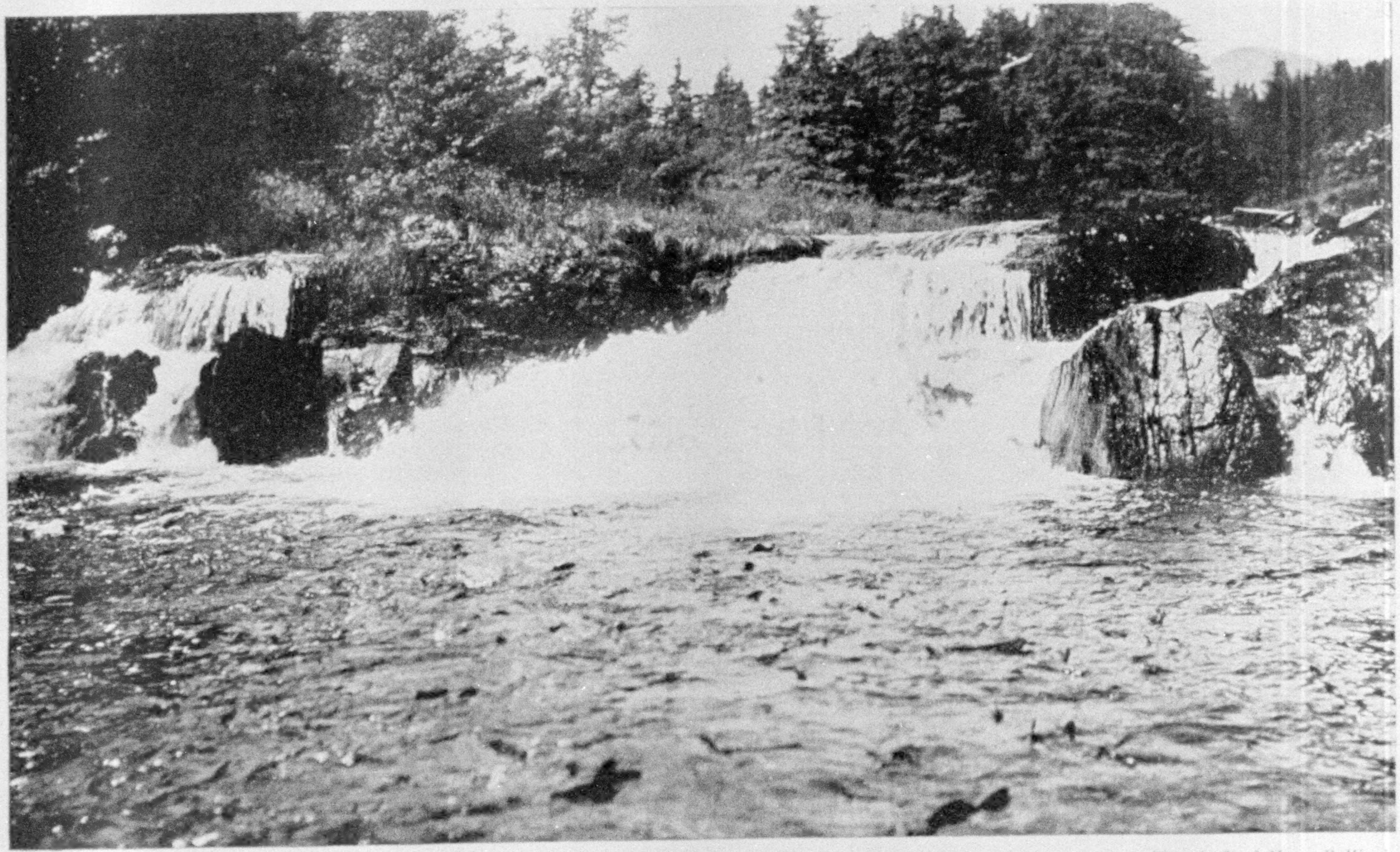


Photo by Prof. Henry B. Ward

SALMON BELOW AND IN A FALLS IN AN ALASKAN STREAM

The leaping powers of the salmon of the North Atlantic have been amply praised in prose and poetry. Not less worthy of admiration are the skill, zeal, and persistence with which the North Pacific salmon overcome obstacles, ascend rapids and cascades, and surmount falls while on their way to their spawning grounds. The bull-dog pertinacity with which the fish continue on their course while rapidly undergoing physical deterioration has hardly a parallel in the whole fish tribe. In the Snake River and the Yukon River they travel 2,000 miles from the ocean, and after once beginning their upward journey they take no food of any kind. Every individual of every species of salmon dies shortly after spawning (see pages 471 and 497-499).

or fear of contradiction, assign the foremost place among fishes to the salmons, which, entering every stream from Golden Gate to Bering Strait, constitute the most conspicuous element of the fish life.

The last estimate is the correct one, for the Pacific salmons are the most valuable fishes not only of the United States, but also of the entire western hemisphere, and, with the single exception of the sea herrings, are commercially the leading fishes of the world.

THE FIVE SPECIES OF PACIFIC SALMONS

The Pacific salmons constitute a distinct group, closely resembling the Atlantic salmon, but separated by marked anatomical and physiological peculiarities.

There are five distinct species, which, having many characters in common, nevertheless differ strikingly in size, color, habits, distribution, food value, and economic importance. All of the species occur on the California coast (to San Francisco Bay or a little further south), and range thence to the far north, crossing to Siberia and reaching southward into Kamchatka, while three of them extend to Japan.

These fishes were first christened in a scientific way by the German physician Walbaum, who, in 1792, invested them with the vernacular names by which they were known among the Russians. The rules of nomenclature require that these names be retained, and hence these beautiful creatures must bear for all time such outlandish names as *kisutch* and *tschawytscha*. It was as late as 1861 that Dr. George Suckley, the naturalist of the Pacific Railroad Survey, recognizing the generic distinctness of these fishes from the ordinary salmons (*Salmo*), gave them for the first time a clan name of their own, *Oncorhynchus*, meaning hook snout.

The largest of the genus, and the most magnificent of all the salmons, is the chinook, quinnat, king, spring, or tyee salmon. It has an average weight of nearly 25 pounds in the Columbia, and is often caught weighing 40 to 60 pounds, while occasionally examples of over 100 pounds are taken. While found from California to China, it attains its greatest abundance in the Sacramento, Columbia, Yukon, and other large streams.

The species called blueback salmon on the Columbia, sockeye on Puget Sound, and redfish or red salmon in Alaska, averages only five pounds in weight and never exceeds twelve. It attains greatest abundance in the Columbia, the Fraser, and in various streams throughout Alaska. Its meat is rich in quality and deep red in color, and the fish is therefore in great demand for canning. While a beautiful fish when in salt water, with bright blue back and silver sides, after entering fresh water it deteriorates rapidly in food value and appearance, the head turns to olive green, and the entire back and sides become crimson and finally dark blood red.

The silver or coho salmon, with a general distribution in the coastal streams, averages 6 pounds in weight and rarely exceeds 25 or 30.

The smallest species is the humpback, so called from the well-marked nuchal hump developed by the male in fall. The extremes of weight for mature examples are 3 and 11 pounds, with 4 pounds as the average. The region of greatest abundance is Puget Sound to southeast Alaska.

The remaining species, the dog or chum salmon, averages 8 pounds in weight. It is generally distributed and abundant, but, owing to the poor quality of the flesh, is the least important of the group. The distortion of the jaws in the male during the breeding season, while characteristic of all the species, is particularly marked in the dog salmon.

INEVITABLE DEATH AFTER SPAWNING

The differences in spawning times and places of the different species of salmon are most interesting. After spending most of their lives at sea, growing, accumulating fat, and storing energy, the salmons move inshore and ascend the streams. After once beginning their upward journey, they take no food, and in fact are physiologically incapable of digesting and assimilating food.

The quinnat salmon begins to run in spring and pushes its way to the headquarters of the larger streams. In the

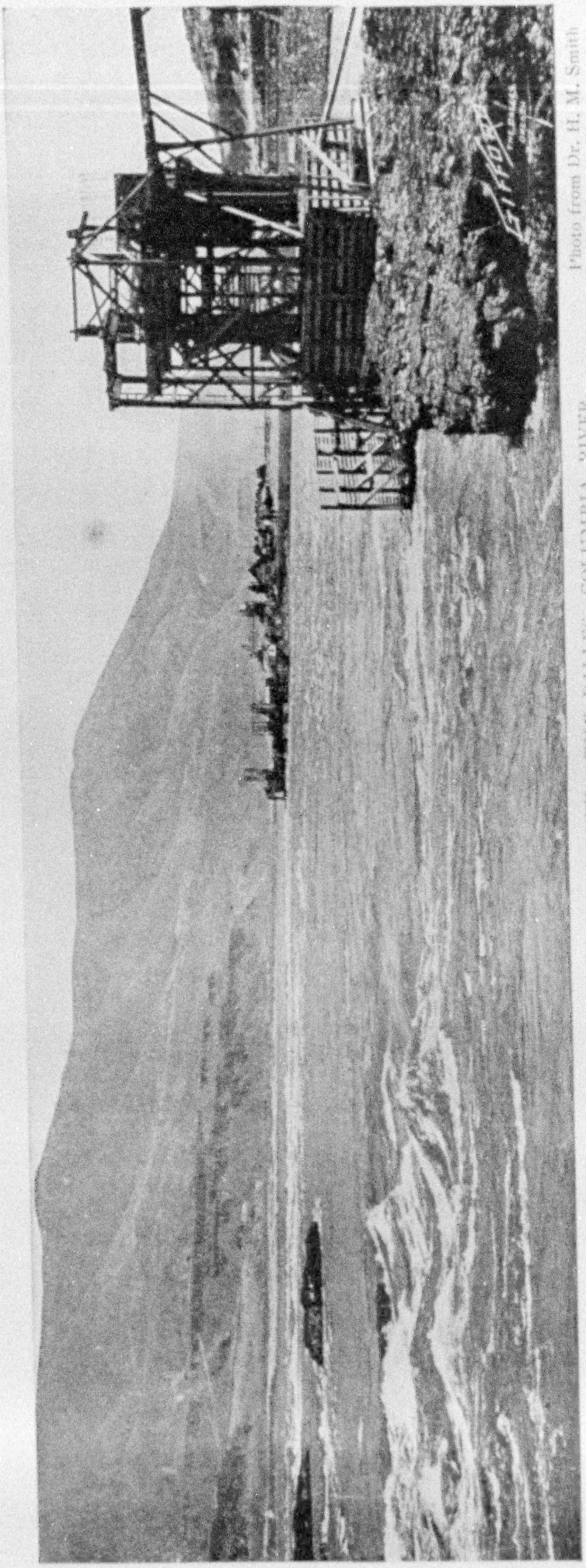


Photo from Dr. H. M. Smith

A STATIONARY SALMON WHEEL: THE DALLES, COLUMBIA RIVER

The salmon wheel has been called the apotheosis of the dip net. It consists of a series of scoops arranged on the priphery of a wheel, which is kept turning by the current. Such wheels, on shore or on scows, are used only in rapids of the Columbia River, and the salmon migrating upstream are caught in large numbers.

Columbia basin the species distributes itself over 90,000 square miles of Washington, Oregon, Idaho, and Montana, its upward limit being insurmountable obstructions or falls. *In the Snake River and the Yukon River the spawning grounds lie 2,000 miles by water from the sea.*

The spawning streams of the red salmon are those that arise in lakes, and the spawning grounds are in the affluents of those lakes. The run begins in May and fish continue to come in until October, depending on latitude.

The silver salmon enters the streams from July to October or November, but does not as a rule ascend for long distances.

The humpback runs into fresh water in summer and fall, preferably in short coast streams, and often spawns within a few rods of the ocean.

The schools of dog salmon come into the stream rather late; in the Columbia River and Puget Sound the run extends from August to late in November, and in Alaska the height of the season is about the first of September.

Now, whether the salmon travel in the streams 2,000 miles or 200 feet to reach their spawning grounds, and regardless of their physical condition at the time they arrive at the particular places required for the proper development of eggs and young, every individual of every species dies shortly after spawning. This is the most characteristic and remarkable event in the life of the Pacific salmons.

Why this is the case is one of nature's mysteries. It has its parallel in some other fishes, in the may-fly, which

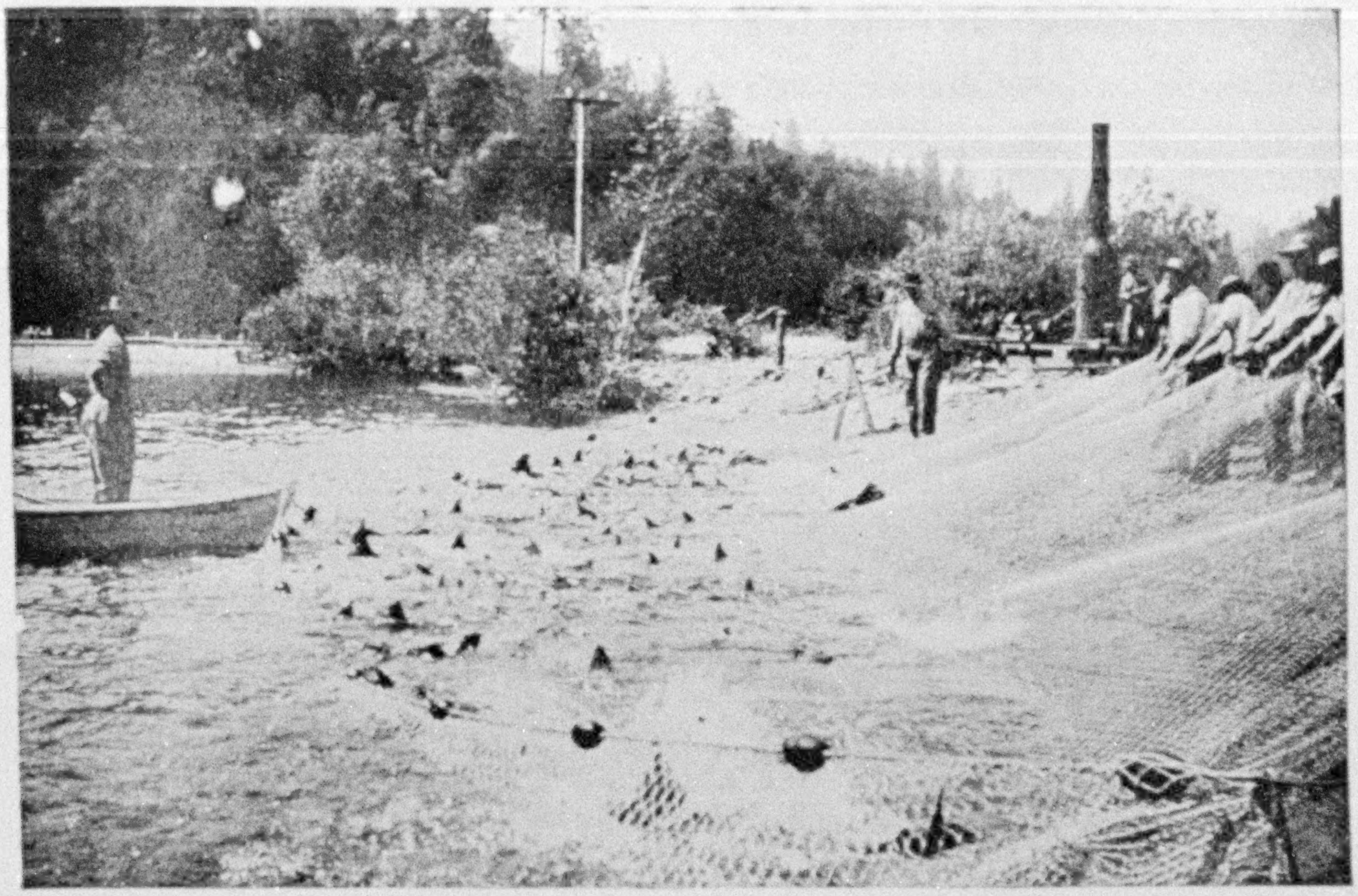


Photo from Dr. H. M. Smith

SEINING SPAWNING SALMON IN THE SACRAMENTO RIVER, IN CONNECTION WITH A HATCHERY.

perishes after a few hours' existence, and in the annual plants. We can only say of such that they have served their purpose and are no longer needed.

The death habit of the salmons was doubtless developed to prevent the overstocking of streams, the exhaustion of the food supply of the young while in fresh water, and the consequent danger of the wiping out of species by mere excess of numbers. This wise precaution of nature has become a positive detriment by the appearance of the human factor on the scene and the resulting destruction of a large proportion of the run of each species each year in practically every stream before the spawning act has occurred.

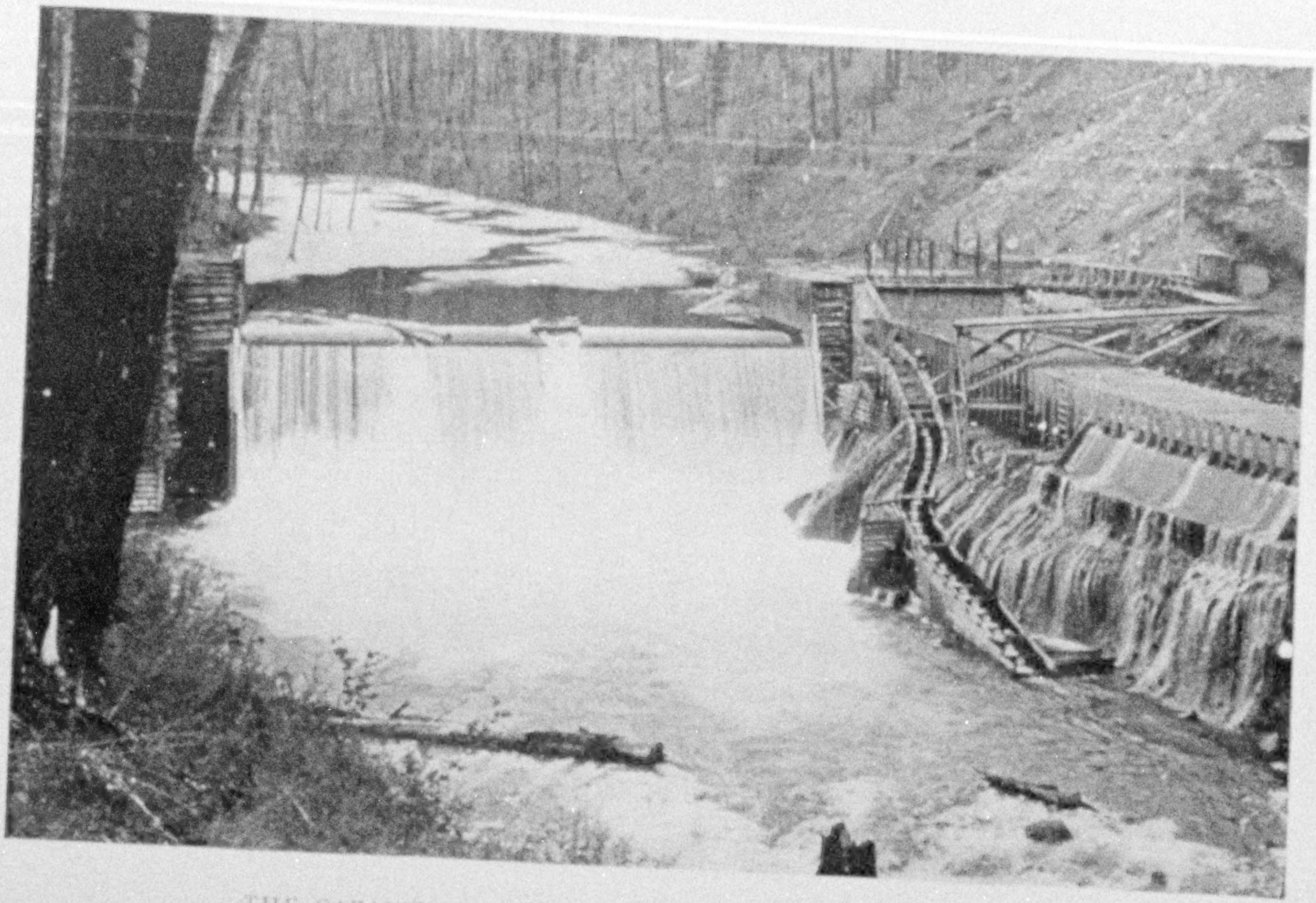
PERIODICITY OF THE RUNS

While the Pacific salmons run with more or less regularity, year after year, two of the species exhibit, in particular streams or regions, a marked periodicity in abundance which is so well established that it can be predicted with certainty years in advance.

The blueback, or sockeye, in certain streams shows a climax in abundance every fourth year. This is especially marked in Puget Sound and Fraser River, where the years 1905 and 1909, for example, were characterized by immense runs, while in 1906 and 1910 the abundance, as shown by the catch, was only one-fourth or one-fifth as great. The quadrennial periodicity in Puget Sound is strikingly shown by the fish caught and canned during the years 1903 to 1910, as follows:

1903	167,211	cases
1904	109,264	"
1905	*825,453*	"
1906	178,748	"
1907	93,122	"
1908	170,951	"
1909	*1,097,904*	"
1910	248,014	"

The case of the humpback salmon in the Puget Sound region is perhaps the best marked example of periodicity. The species there is biennial in its appearance. One year it comes in incalculable numbers, crowding the streams, filling the



THE CAZADERO DAM, ON THE COLUMBIA RIVER, OREGON

Note the fish ladder just to the right of the dam. The fish attack the fall along its entire length, but the best place from which to photograph them is in the corner under the head of the ladder. The Cazadero Dam is 40 feet high, so of course it is impassable, but the fish never seemed discouraged. Morning and evening, all during the run, they leaped at the foot of the apron, apparently undaunted by the heavy blows received in landing on the bucket or the rocks (see photos, pages 506 to 515). The hatchery is located in a curve of the big flume leading from the dam, and about a quarter of a mile downstream. Photo and note by Shirley C. Hulse.

nets, and giving canners all the raw material they can use. The next year the species is so scarce as to be practically absent.

In 1907 the Puget Sound canners prepared 433,423 cases of humpbacks, but in 1908 they were able to secure only enough fish to make 6,075 cases. In 1909 the pack was 370,993 cases, while in 1910 only 108 cases could be filled. During the six even years immediately preceding 1908 the statistics show no humpbacks whatever canned.

This periodicity is an indication of the age of the fish when mature. In the case of the blueback, a large run, with the deposition of a large quantity of spawn, has its major effect four years later in the same region—that is, the normal life of this species, from its birth as an egg to its death as a parent, is four years. The humpback, on the other hand, is a biennial species, a heavy run, with a corresponding egg crop, having its effect two years later. Dr. Charles H. Gilbert, who has made prolonged studies of the Pacific salmon in the interests of the government, announces, as a practically accurate statement of fact, that the humpback dies on its second birthday.

In view of the excellent quality of the humpback and its growing importance as a fresh and preserved fish, the government now proposes to make a determined effort to establish in Puget Sound a large run during the off years. This experiment will extend over several seasons, and will involve the transfer from Alaska of perhaps a hundred million humpback eggs for hatching on Puget Sound. If successful it will prove tremendously important commercially, and incidentally the efficacy of artificial propagation will be submitted to a crucial test.

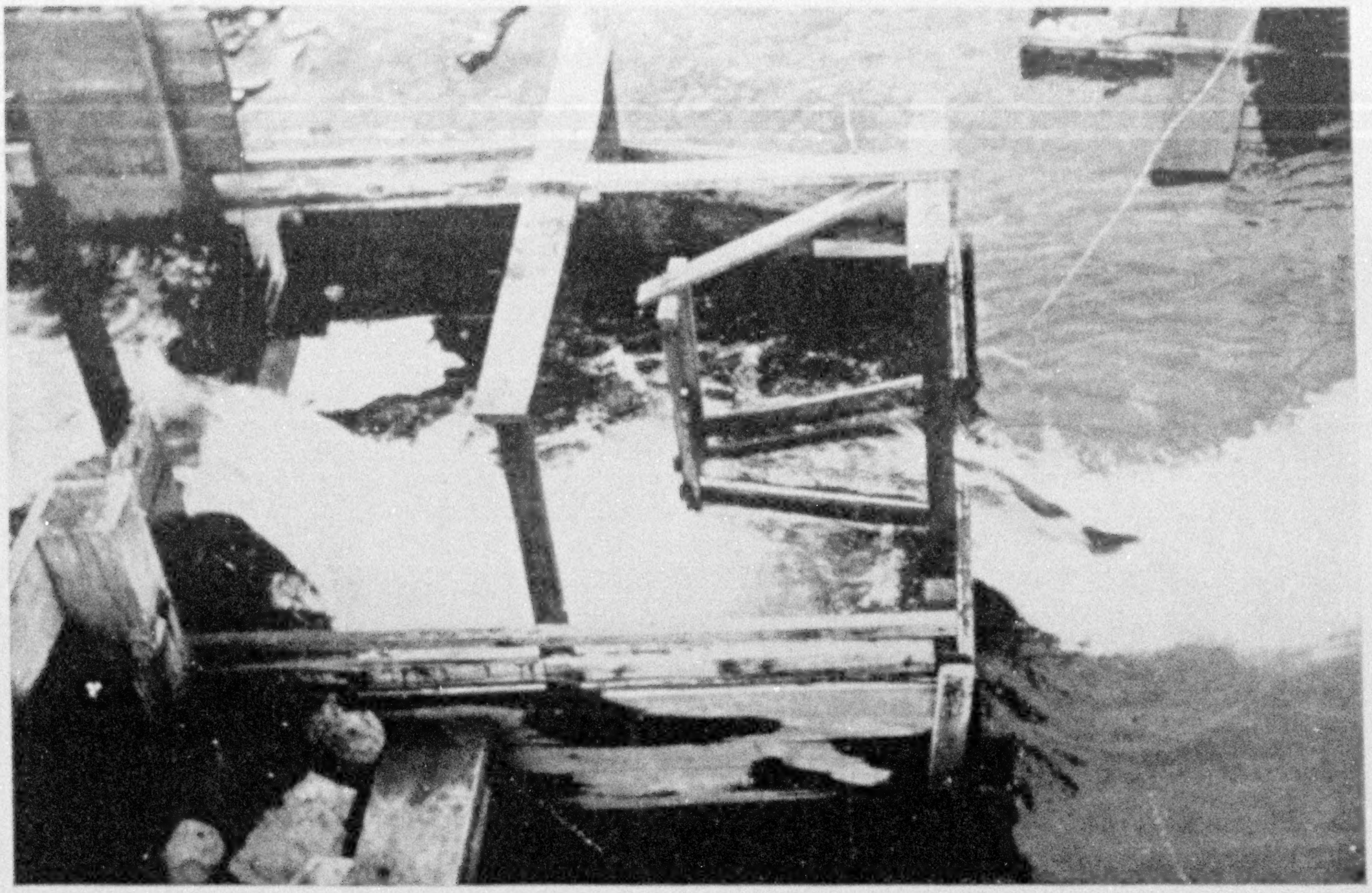


Photo by Shirley C. Hulse

SALMON ENTERING THE FOOT OF THE FISH LADDER

This is used as a trap, and as fast as the fish are "ripe" they are taken out and spawned artificially (see pages 502-509)

THE SALMON'S "INSTINCT OF NATIVITY" AND THE PARENT-STREAM THEORY

One of the most deeply seated and widely entertained theories regarding the salmons (and other species of similar habits) is that by virtue of a mysterious faculty, which has been called the instinct of nativity, these fishes return to spawn in the same stream in which they were hatched.

The advocates of this view find support for it in some well-known facts in the life of the salmons, such as the occurrence of distinctive runs in particular streams, the return of marked fish, response to plants of large numbers of young, etc. Without entering into a discussion of this question, it may be said that in so far as the theory is borne out by facts, the latter may be explained without the necessity of investing the salmon and other anadromous fishes with a higher order of intelligence than is possessed by any other creatures.

It is true as a general proposition that the fish hatched in a particular stream return to that stream to spawn, but this is largely because that is the most natural and most accessible place to go, and it is more remarkable when they go elsewhere, as they frequently do.

The schools of salmon when sojourning in the ocean, preparing for their all-important function, do not roam many miles distant from the mouth of the particular stream in which they were born and spent the early months of their life. Having reached the proper age, they are impelled by the spawning instinct to move shoreward, and they eventually come within the influence of the fresh water discharged into ocean, gulf, or bay by a stream that is more likely to have been the "parent stream" than another. It thus happens that streams pouring a vast volume of fresh water into the sea, like the Columbia and Fraser, and streams whose mouths are more or less remote from others, like the Sacramento, are likely to induce the return of a large

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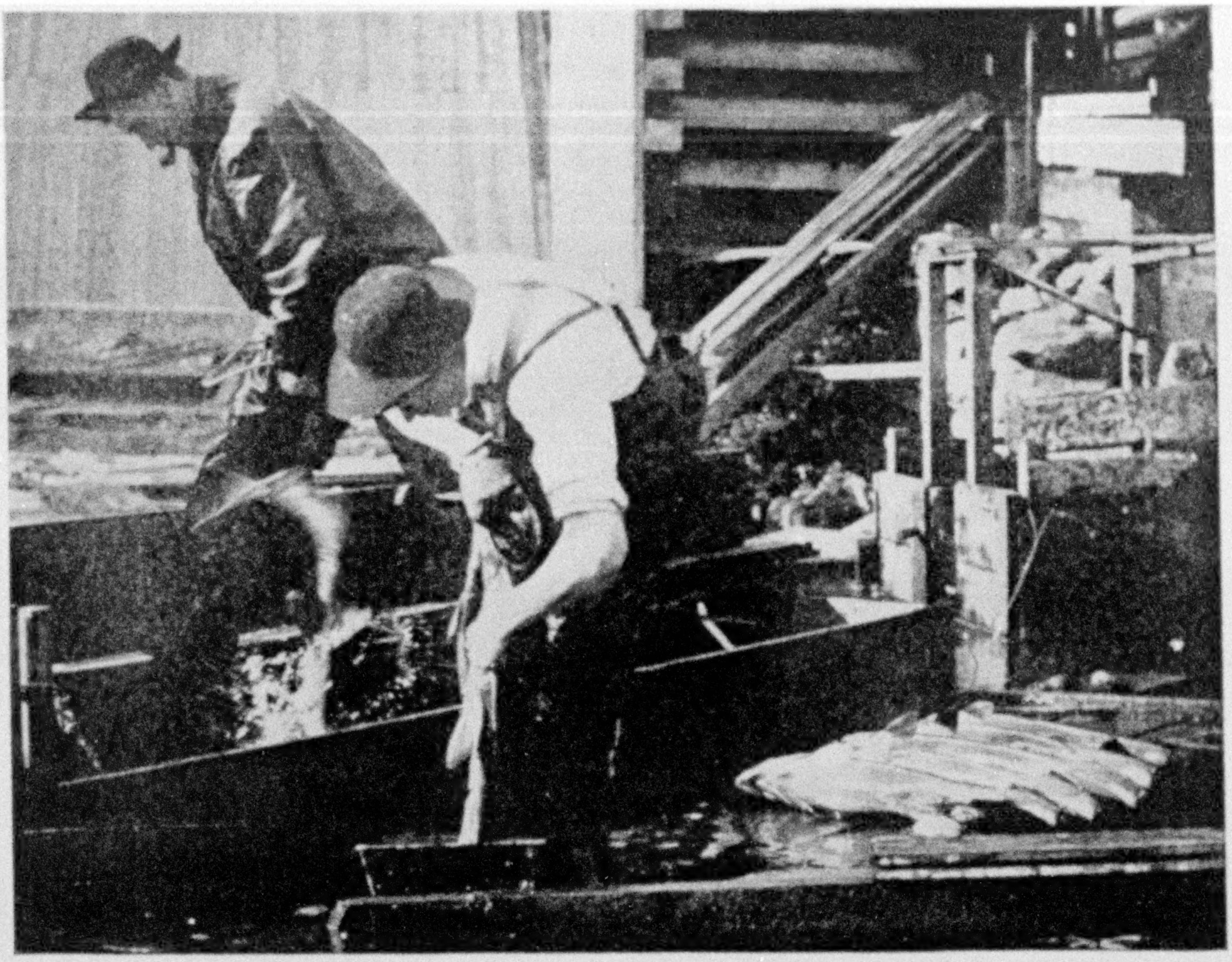

Photo by Shirley C. Hulse

REMOVING THE EGGS FROM A RIPE FEMALE (SEE PAGES 503, 506, AND 507)

proportion of the fish that originally proceeded therefrom.

On the other hand, there is no reason to doubt that the salmon spawned in contiguous coastal streams or in particular tributaries of a large river return indifferently to any of those streams or tributaries, depending on conditions (storms at sea, floods, temperature of coastal or river water, enemies, etc.), which vary from season to season.

GOVERNMENT AND STATE EFFORTS TO INCREASE THE SALMON SUPPLY

The artificial propagation of salmon in the streams of the Pacific seaboard began at a comparatively early date and has continued with yearly increasing extent and importance, so that at the present time more hatcheries are devoted to the Pacific salmons than to any other fishes of the Western Hemisphere. The vast interests at stake have appeared to warrant and to require all the money that could properly be expended by the Federal and State governments for salmon culture.

It was believed at the outset that dependence would have to be placed on artificial propagation to offset the tremendous drains made on the supply by man and other destructive agencies, and it was generally maintained at a very early period in the history of the salmon industry that with adequate cultivation the fisheries could increase almost indefinitely.

The first salmon hatchery in the West was established in 1872, on the McCloud River, in California. By executive order there was set aside a large tract for a "piscicultural preserve," which was fittingly named Baird, after the first national commissioner of fisheries; and Livingston Stone, a pioneer fish culturist, who is still alive, was placed in charge and continued in that capacity for many years, overcoming many obstacles, under-

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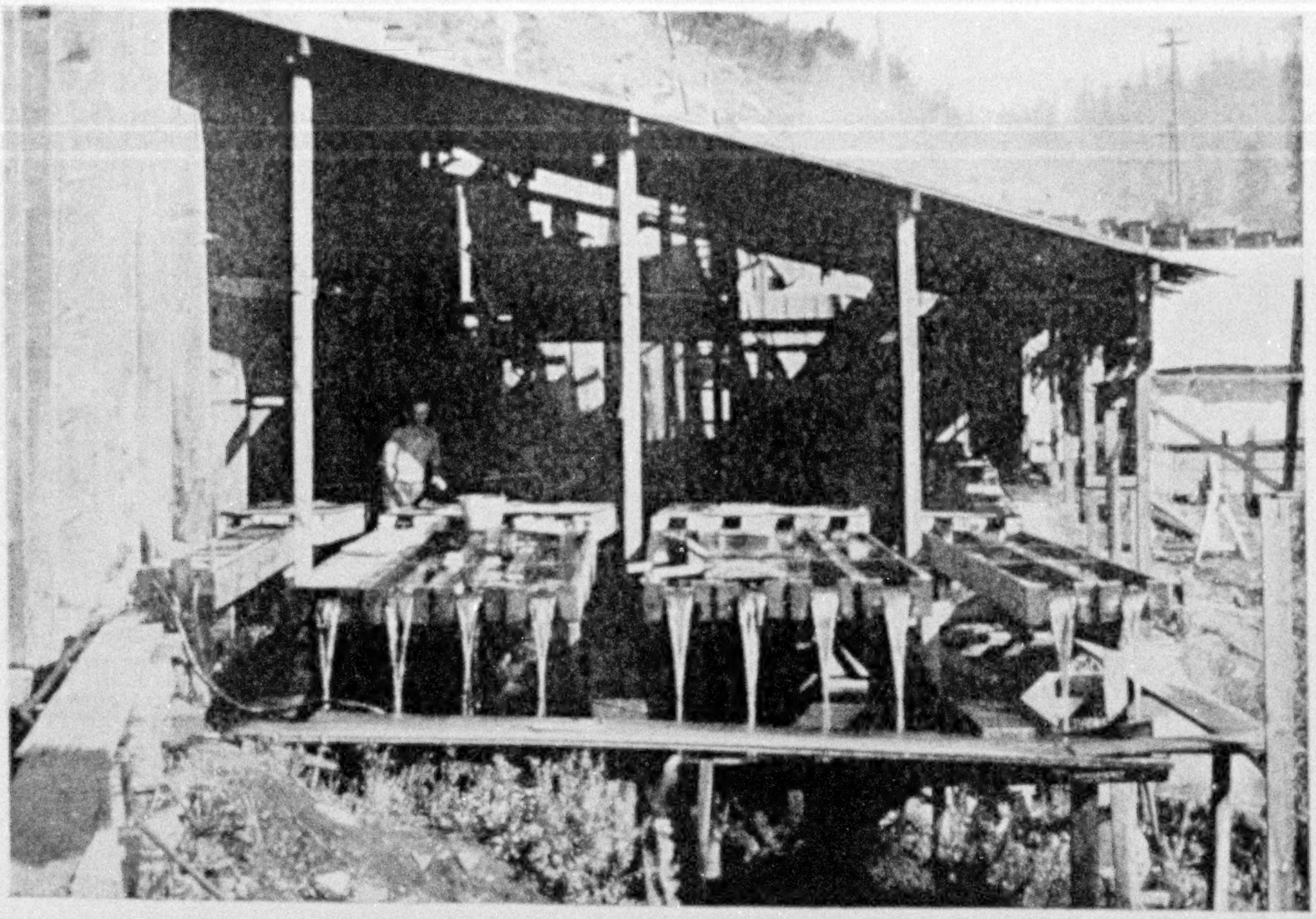

A FIELD HATCHERY OF THE STATE OF OREGON

Here the eggs are put in troughs of running water, in which they hatch after a greater or less period, according to the temperature of the water. The eggs are picked over every day and all sterile or objectionable ones are thrown out. It is necessary to screen the troughs at this place on account of birds, which enter boldly and steal the eggs. The water ousel is the worst of these thieves. Note and photo by Shirley C. Hulse.

going many privations, repeatedly subjected to great danger from attacks of Indians and outlaws, and devising methods which showed the possibilities of salmon culture and led to the present extraordinary development of this art.

The original Baird hatchery, still in active operation, is now supplemented by numerous other government stations, which may be regarded as lineal descendants. Two of these are in the Sacramento Valley, in California; four are in the Columbia basin, in Oregon and Washington; four are in the Puget Sound region, and two are in Alaska. The three Pacific-coast States now maintain more than 30 salmon hatcheries, the largest number being in Washington. In British Columbia 11 hatcheries are operated by the government.

A feature of the salmon industry which is not met with in any other branch of the fisheries has been the establishment and maintenance by private interests of hatcheries on various parts of the coast. At present this practice is confined to Alaska, where, in 1911, five hatcheries belonging to canning companies produced and liberated many millions of young red salmon.

THE VAST EXTENT OF SALMON CULTURE

The eggs of the salmons are .2 to .25 inch in diameter, and are the largest handled by the fish culturist. They are easily obtained by intercepting the fish on their way to the spawning grounds by means of racks, traps, seines, etc., and then, when exactly ripe, by expressing by firm pressure on the abdomen.

The size and activity of the salmons make it necessary for two or three men to work together in holding the fish and relieving them of their eggs and milt, and the largest individuals are most readily managed by putting them in a straight jacket.

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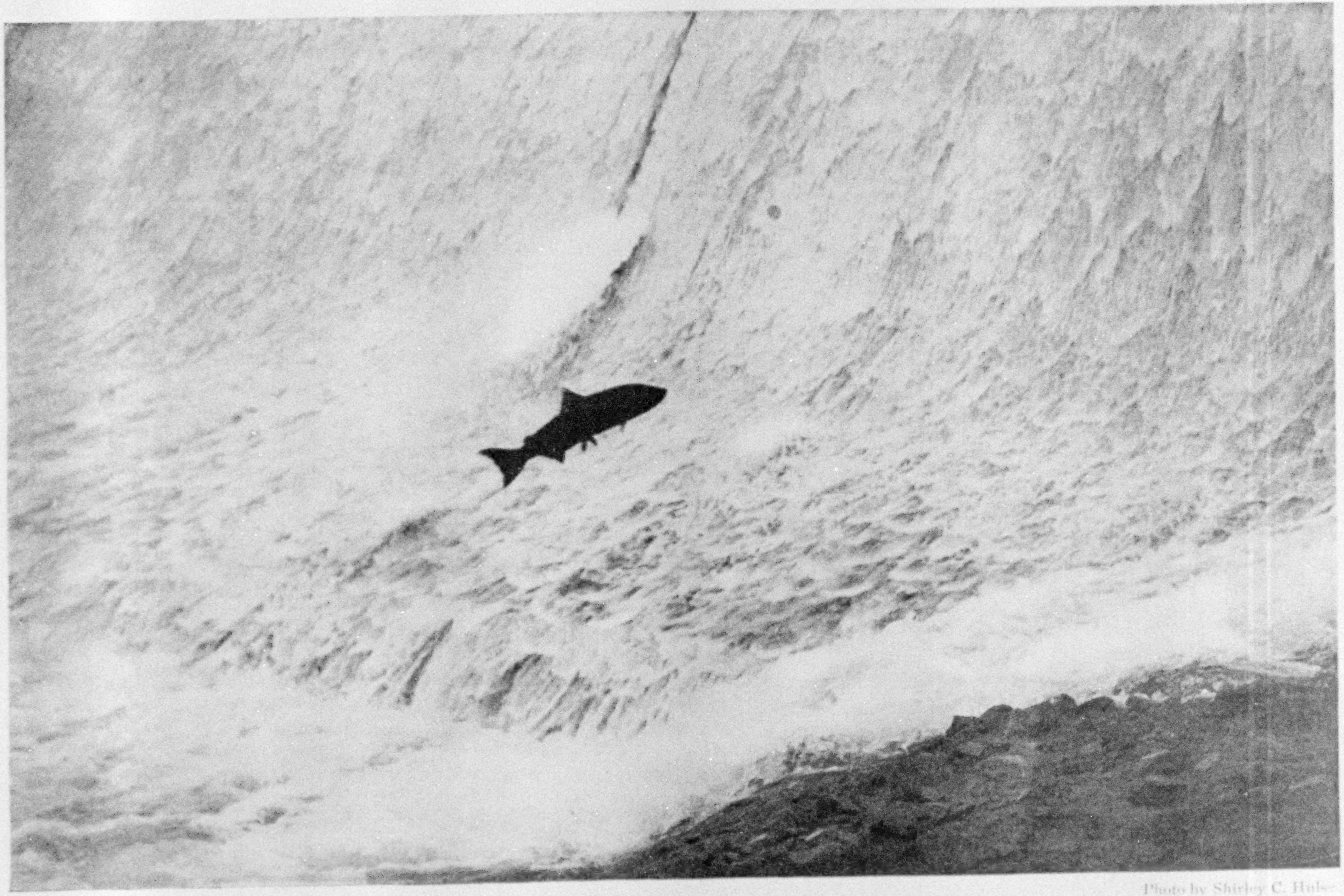
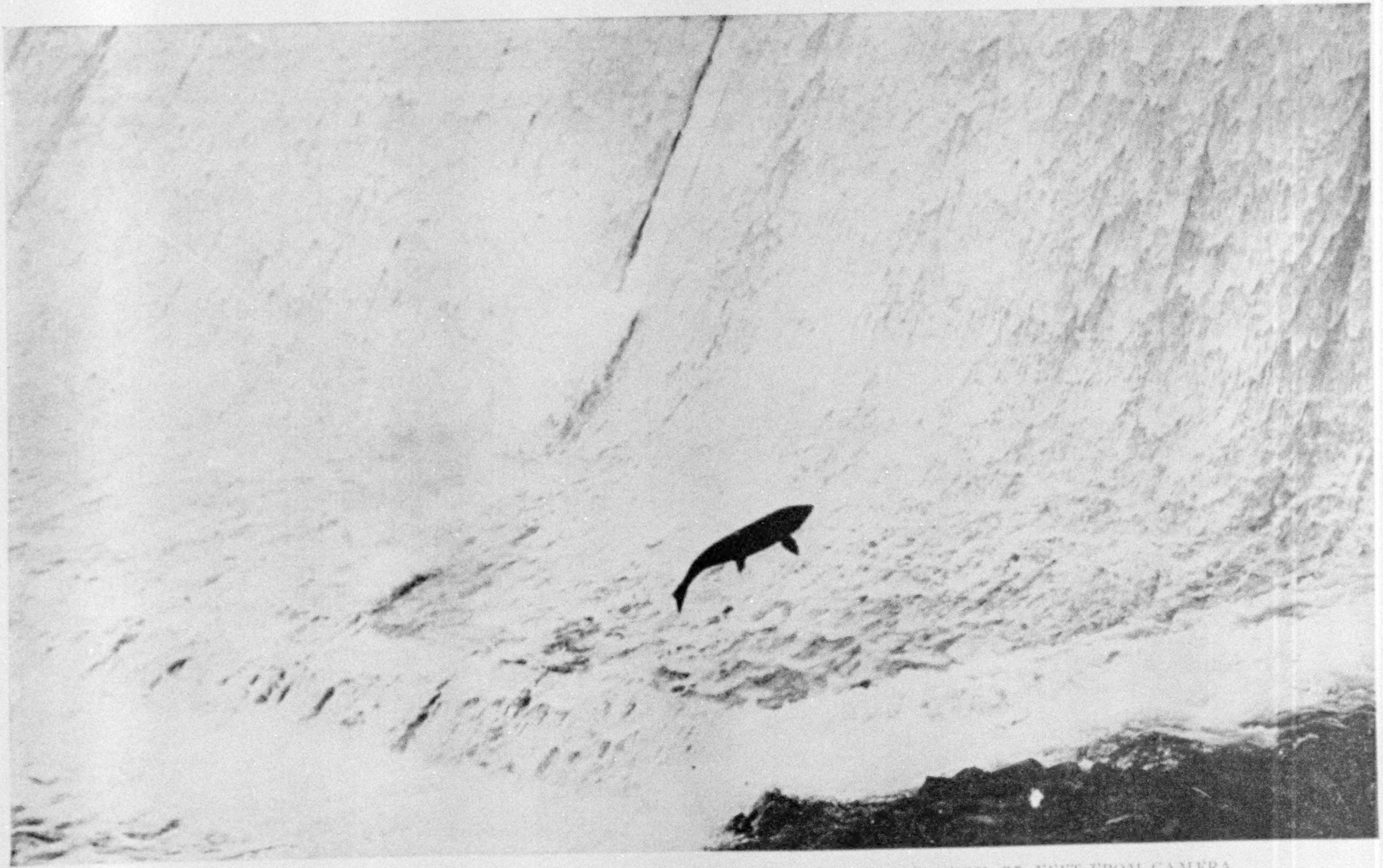


Photo by Shirley C. Hulse

A CHINOOK SALMON MAKING A LONG, CLEAN JUMP ONTO THE APRON OF THE DAM: FISH 25 FEET FROM CAMERA (P. 500)



SALMON ATTEMPTING TO SURMOUNT THE CAZADERO DAM (SEE PAGE 500): FISH 25 FEET FROM CAMERA

The leaping salmon are hard to photograph. The water reflects a great deal of light and the fish very little. One may take a good picture of either the water or the fish, but to get both on the same negative is the difficulty. I have purposely forgotten how many rolls of film I spoiled before I got good pictures, but they were not a few, and with each attempt at fish photography I always expected and usually got a thorough soaking from the icy spray of the falls and a hard tumble or two on the slippery rocks. Photo and note by Shirley C. Hulse.

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Photo by Shirley C. Hulse

FISH 10 FEET FROM CAMERA

In view of the inevitable death of the salmon after spawning, an improvement over the old method of forcible expulsion of the eggs is the stunning of the fish by a blow on the head and the taking of the eggs by abdominal section. This, while greatly facilitating the work of the spawn-takers, adds approximately 10 per cent to the egg yield by the saving of eggs that would ordinarily be left in the abdominal cavity.

Salmon eggs hatch slowly. Incubation, beginning in late summer or early autumn, continues until the following spring or summer, depending on the temperature of the water. The most protracted period of incubation thus far coming to the notice of fish culturists is that of the red salmon at Karluk, Alaska, where eggs taken in September may not hatch until the following May or June, and in certain seasons the hatching time has been prolonged to 270 days.

The annual deposits of young salmon in the waters of the Pacific seaboard by the Bureau of Fisheries, the three coast States, the province of British Columbia, and the private hatcheries in Alaska now total from 450 to 500 million, of which the largest quantity represents the work of the Federal government.

The human effort represented by this

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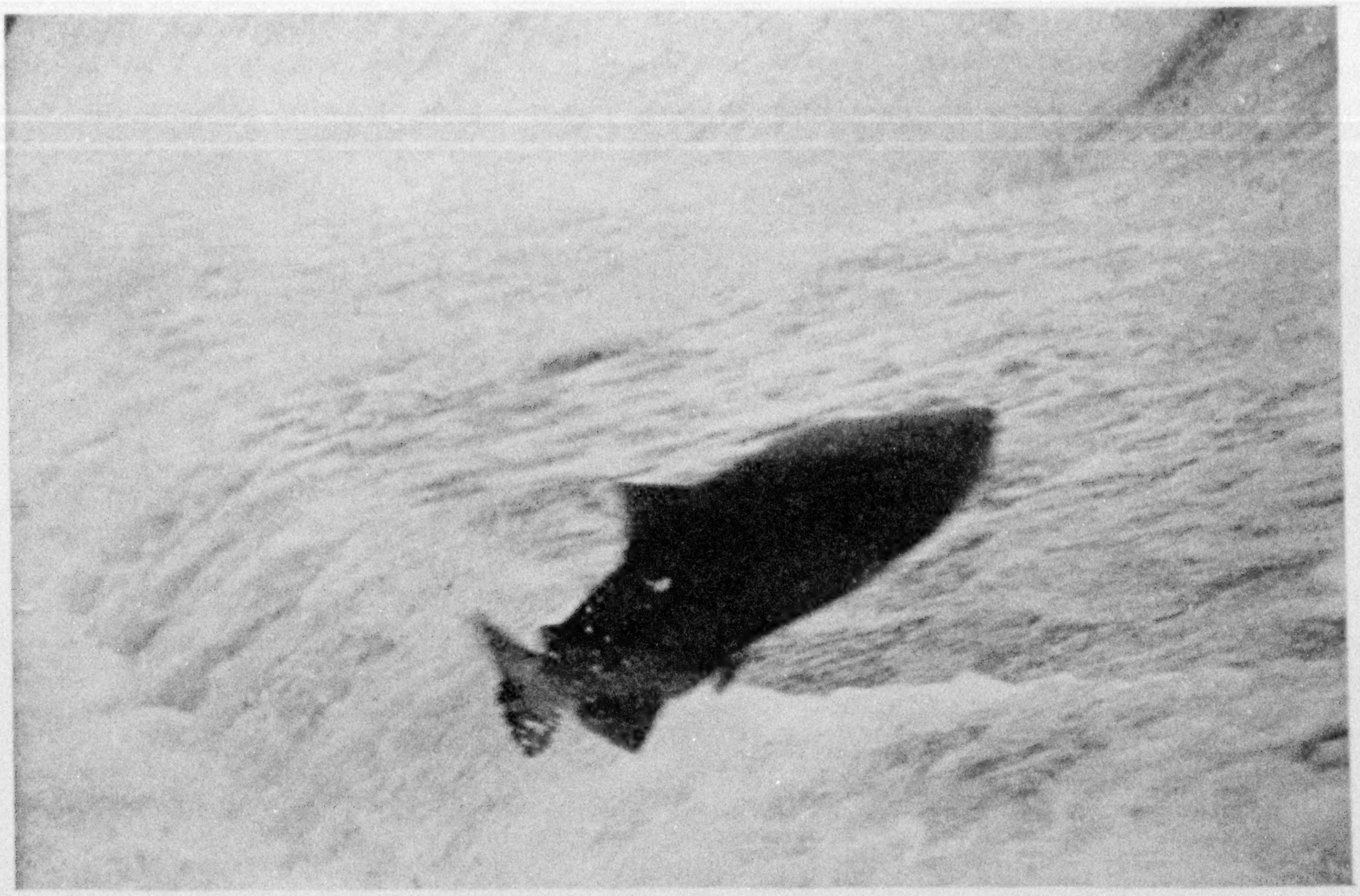

This big fellow jumped directly at me as I stood near the edge of the apron, and as I dodged him I unconsciously snapped the camera. The fish was only three or four feet away, and he threw water all over the camera and nearly ruined it. Photo and note by Shirley C. Hulse.

tremendous output may perhaps be better appreciated when a season's take of eggs is considered as a commodity. The average number of salmon eggs to a bushel may be given at 125,000. The number of eggs taken, fertilized, and incubated by the United States Bureau of Fisheries at its California, Oregon, Washington, and Alaska hatcheries in 1911 was equivalent to 1,500 bushels. The salmon-egg harvest of the other efficient agencies indicated would bring the yearly total up to 4,500 bushels.

HOW MAN IMPROVES ON NATURE

In the discussions of important economic questions affecting natural resources, especially animals, the contention is sometimes made that man cannot improve on nature's methods. This plea, which impresses many people and conduces to neglect of the needs of some of our most valuable creatures, is most emphatically and clearly refuted in salmon culture.

It is a matter of general observation that nature is most prodigal in producing fish eggs and young far in excess of the needs of the species, and permitting the destruction of a very large percentage of the progeny before maturity is reached. With the advent of the human factor, there is a disturbance of the nice balance that had come to be established, and it is then that fish culture is demanded and justifies itself by saving a large proportion of the eggs and young that are ordinarily sacrificed.

Just how effective are the operations of the salmon culturist, and how strongly artificial propagation is now demanded because of the enormous drains that are made on the small remnants of the original progeny that have reached the reproductive age, may be seen from the following comparison:

Under ordinary conditions of natural propagation, a certain small percentage of the ripe eggs are not extruded, but remain within the body of the female, and are therefore wasted; from 10 to 20 per cent of the total number of eggs escape fertilization; a very large proportion (60 to 80 per cent) of the eggs are

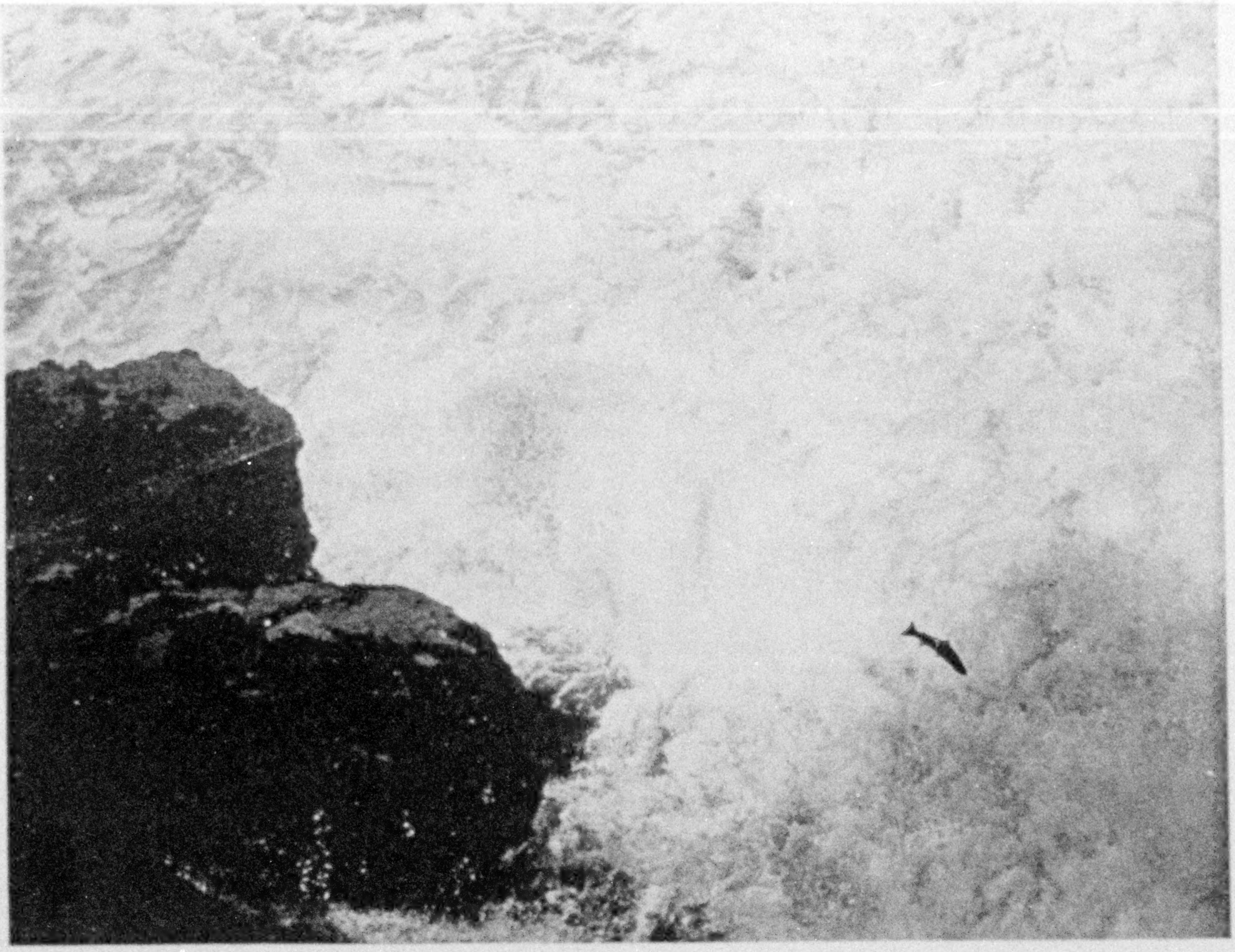

Photo by Shirley C. Hulse

SALMON LEAPING OVER THE SWIFT WATER NEAR THE TOE OF CAZADERO DAM AND SEEN FROM ABOVE

destroyed by predaceous fishes and other agencies; and, while the newly hatched young are in the helpless non-swimming stage, burdened by the heavy yolk-sac, they are such easy victims and such dainty morsels to the myriads of fishes that infest the spawning grounds, that an additional loss of 10 to 15 per cent occurs, so that of the original crop of eggs, only 1 to 2 per cent reach the age to which the fish culturist carries the young salmon.

Under the present effective methods of artificial hatching, the total losses up to the time when the young are set free in the rivers, amply able to care for themselves, although still liable to considerable mortality before reaching the ocean, are not more than 20 per cent, are frequently only 10 per cent, and should not exceed 15 per cent under average conditions.

Therefore, as against an absolute loss of 98 or 99 per cent in nature, the fish culturist is to be credited with a saving of 85 per cent.

The natural mortality among young salmon in the rivers decreases rapidly as the fish become stronger, more active, and more alert. The most important advance that salmon culture can make will therefore be in retaining the young at the hatcheries for a longer period before turning them loose in open waters to shift for themselves. There is no particular difficulty in rearing salmon in captivity; the difficulty lies in providing at a given hatchery the necessary artificial pond area in which to hold and feed perhaps 100 million rapidly growing fish.

EXTENT OF THE SALMON INDUSTRY

The salmon industry on the Pacific coast owes its origin, rapid development, and present extent to the establishment of canneries. During the 50 years that have elapsed since salmon canning began, more than 85 million cases (each holding 48 one-pound cans or the equivalent) have been packed. The fresh weight of the salmon entering into this output has been over five billion pounds. Recent years have witnessed marked changes in the relative amounts of salmon canned, salted, and sold fresh or refrigerated, but much the largest proportion of the catch is still canned, and this will necessarily be the case for years to come.

Salmon fishing is conducted throughout the range of the salmons, but the industry is most extensive in or near the mouths of certain streams, chief of which are the Sacramento, Columbia, Fraser, Skeena, Karluk, and Nushagak. Most of the fishing in Alaska is in bays, straits, and sands adjacent to small streams.

In 1909 the aggregate catch of salmon in the Pacific States, British Columbia, and Alaska was upward of 400 million pounds, which, as sold in a canned, salted, smoked, frozen, or fresh condition, had a market value of about $27,750,000. The canned product alone, consisting of more than five million cases of 48 one-pound cans, was worth $25,500,000. Thirty-five thousand people were engaged in the different branches of the industry, and the invested capital was fully $30,000,000.

ALASKA'S ENORMOUS SALMON RESOURCES

Many years have elapsed since Alaska ceased to be "Seward's Folly," because Alaska for a long time has annually more than repaid her purchase price in salmon alone. The salmons have in fact been Alaska's most valuable contribution to the world's needs, exceeding in abundance and importance those of any other region.

The salmon industry may be said to have began in 1878, when the first cannery was operated. The exploitation of the different sections has progressed rapidly, and in 1911 the catch was probably the largest ever made, amounting to about 44 million fish, weighing nearly 208 million pounds.

While all of the five species occur in Alaska, they differ markedly in distribution and relative abundance. The red salmon is most numerous in central and western Alaska, where three-fourths of the catch is obtained. On the other hand, nine-tenths of the output of humpbacks and a large proportion of the other species come from southeast Alaska. The preponderance of the red and humpback species is shown by the fact that of the 44 million salmon utilized in 1911, about 17½ million were the former and 21½ million the latter.

To have transported, in a fresh condition, the output of 1911 would have required a train of 6,900 freight cars, each holding 30,000 pounds of fish. If placed end to end, the fish would have extended in an unbroken line from New York to San Francisco, back to New York, and again to San Francisco.

FEDERAL GOVERNMENT SUPREME IN ALASKA

Interest in the salmon fisheries of Alaska is increased by the fact that they are under the jurisdiction of the Federal government. The remarkable development of the industry and its flourishing condition are to be attributed in great measure to the wise policy adopted by the government in encouraging the utilization of the resources while safeguarding the supply. Under the wise laws made by Congress, supplemented by the large discretionary powers invested in the Secretary of Commerce and Labor, the salmon fisheries ought to remain unimpaired for an indefinite period.

The major key to the situation is the authority to close to all fishing for a term of years any stream in which the extent of the fishing is disproportionate to the number of fish that are allowed to reach their spawning grounds.

Although the fishery force available for patrolling the Alaskan coast is woefully inadequate, yet even in the most remote and seldom visited parts there is a wholesome sentiment for salmon protection, and violations of the law are surprisingly few.

The large fishing companies, with immense vested interests, are vitally concerned in the perpetuation of the salmon supply, and are willing to meet the gov-

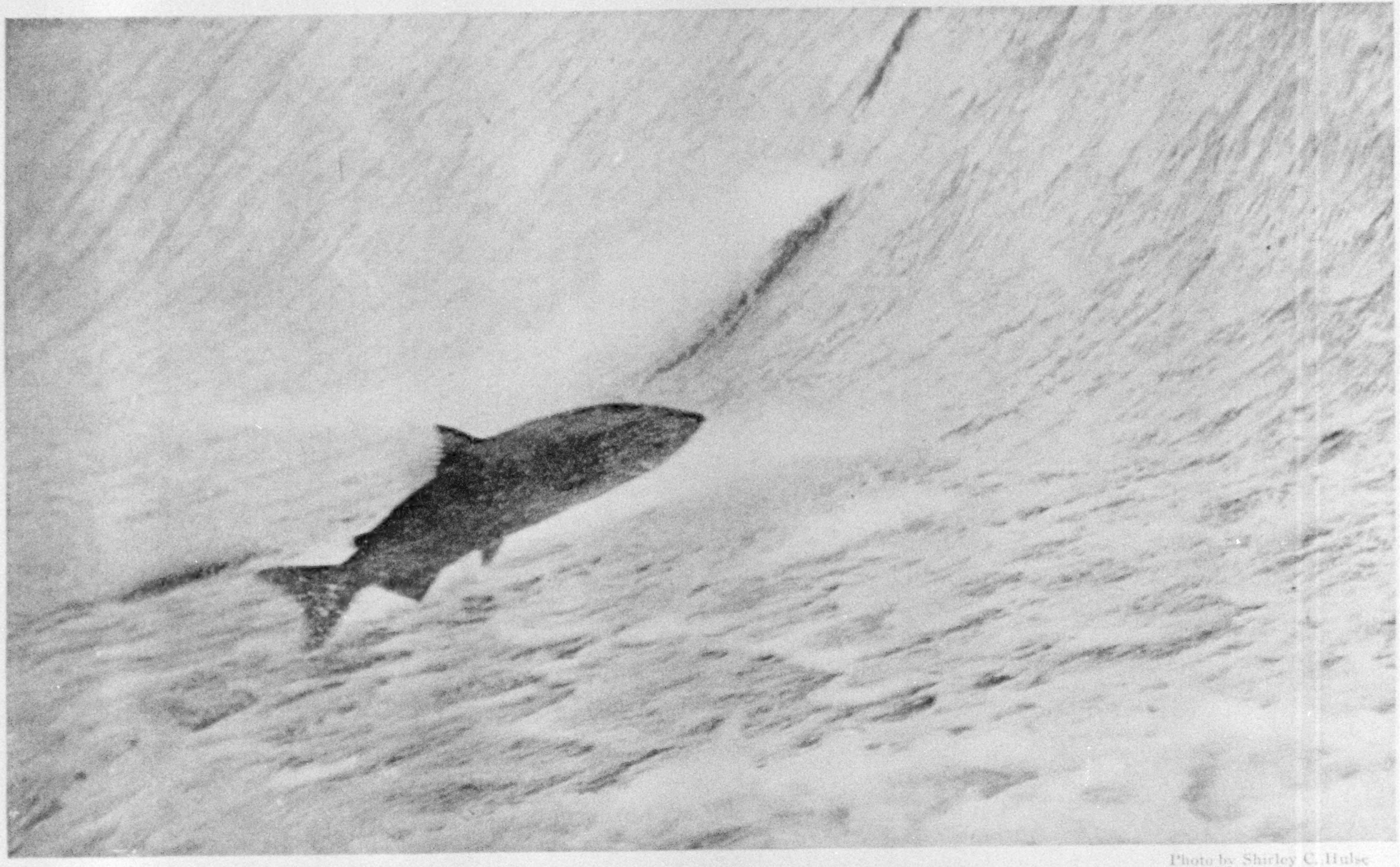

Photo by Shirley C. Hulse

A SPLENDID CHINOOK SALMON, PHOTOGRAPHED WHEN ONLY 10 FEET FROM CAMERA

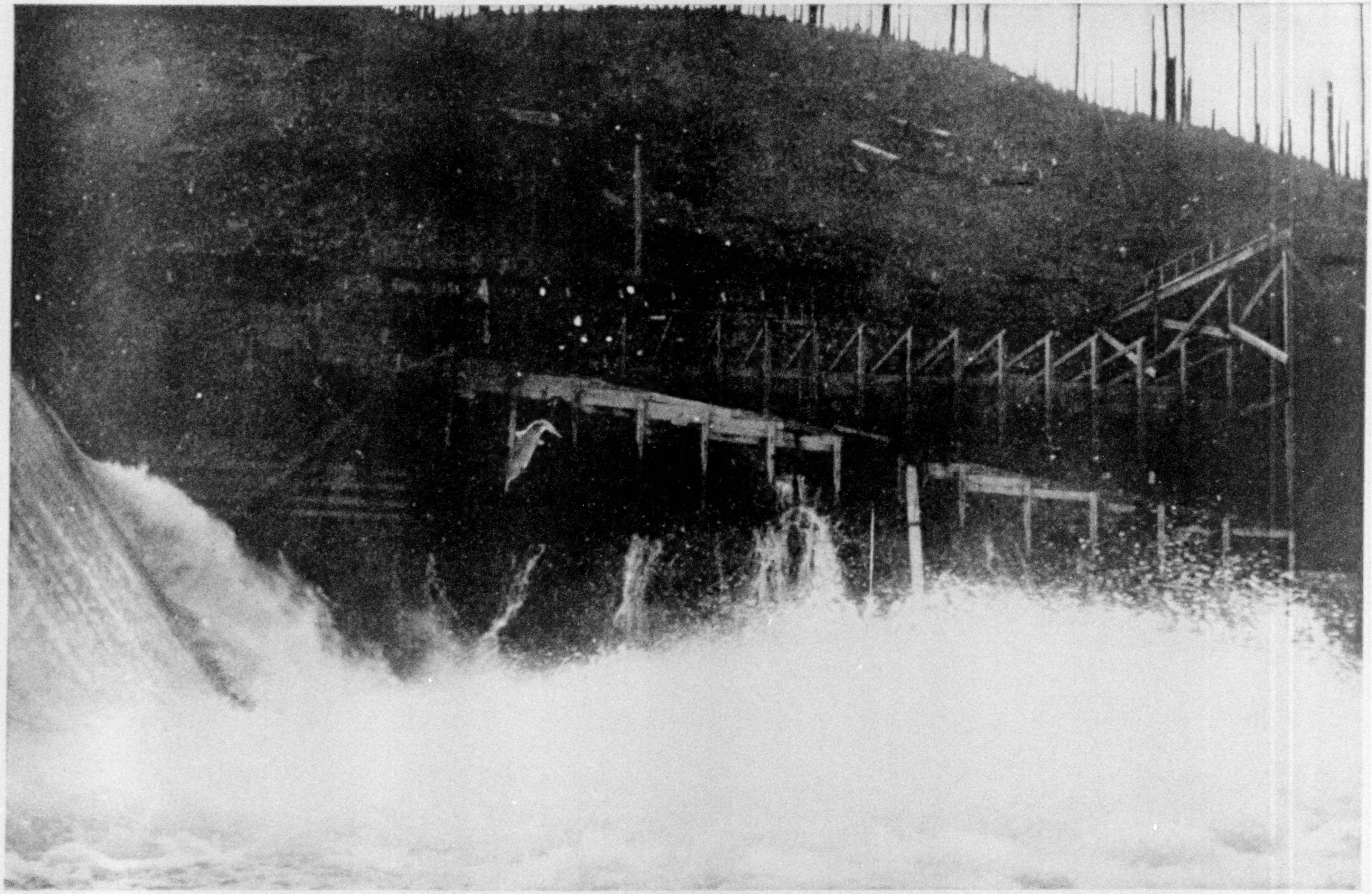

Photo by Shirley C. Hulse

THIS SALMON LEAPED A LITTLE TOO SOON AND WAS WHIRLED OVER AND OVER IN THE AIR

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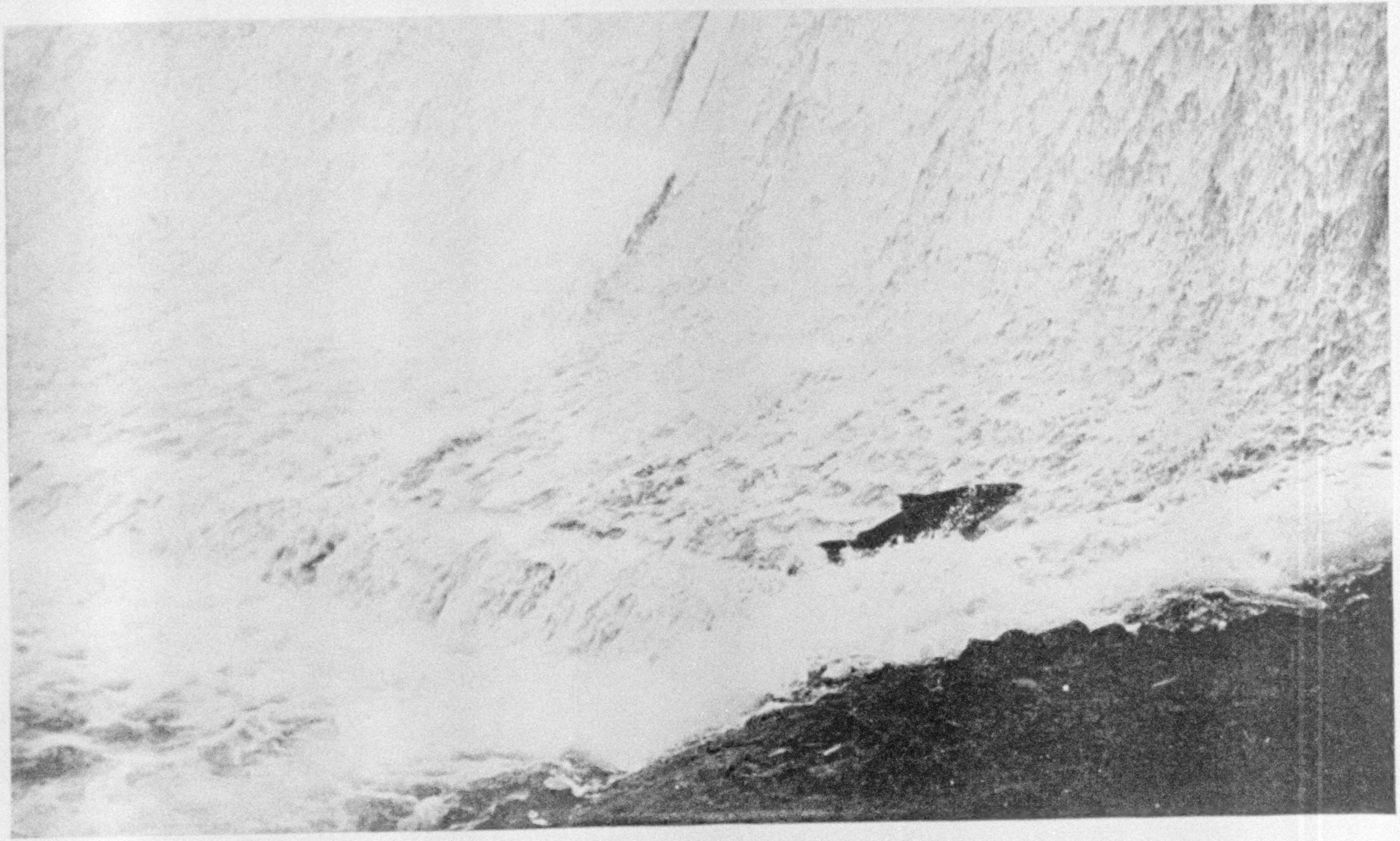

SALMON SWIMMING UP THE SURFACE OF THE APRON IN THE SWIFT WATER BELOW THE CAZADERO DAM

The strength of these fish is evidenced by their wonderful runs through water which would seem calculated to dash them to pieces. No rapid is too rough for them to scale and no fall is too high for them to attempt. I have seen them run under a power-house into the draft-tubes and buck the current till they were washed back, limp and exhausted. They would then retire to a still place, rest up, and come back to try it again. It is said that by leaping and swimming they can surmount a 20-foot fall, and I believe that there is no doubt that they can make a 12-foot fall. Photo and note by Shirley C. Hulse.

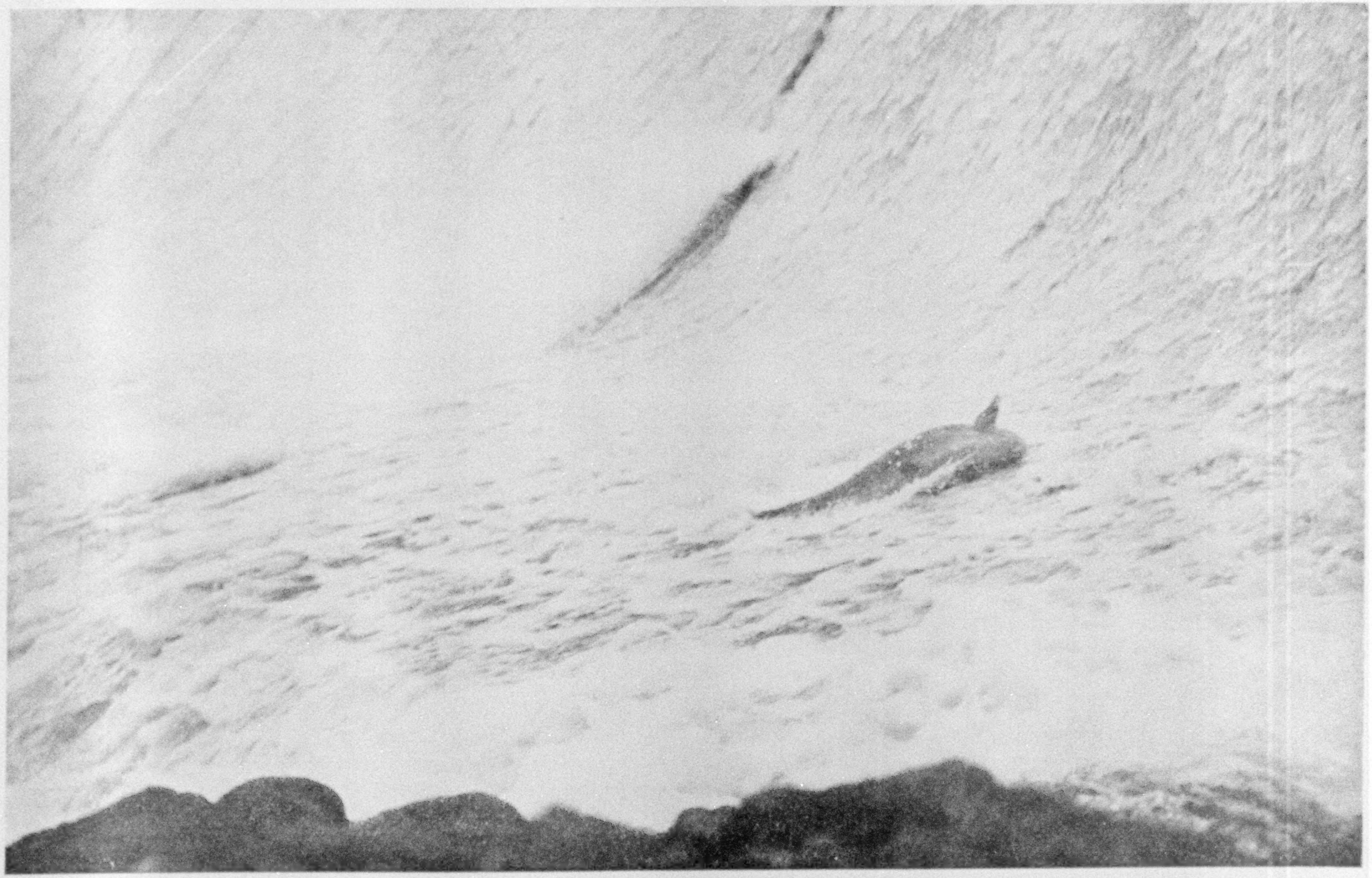

Photo by Shirley C. Hulse

AFTER LANDING ON THE APRON, THE FISH ARE PROMPTLY WASHED BACK TO THE POOL BY THE CURRENT, ONLY TO TRY IT AGAIN AND AGAIN ernment half way in inaugurating and enforcing measures for the prevention of overfishing or other destructive methods.

One of the most novel and interesting pieces of work conducted by the Bureau of Fisheries in connection with the administration of the Alaska salmon fisheries is the taking of a census of the spawning salmon moving up one of the principal streams in the territory. The results and the purport of this effort are most important, and a brief account is not out of place here.

Since 1907 Nushagak and Wood rivers, which flow into Nushagak Bay, in western Alaska, have been closed to commercial fishing by virtue of the power conferred by law on the Secretary of Commerce and Labor. In 1908, through the liberal coöperation of two salmon companies operating in the region, the Bureau at great expense and labor placed across Wood River an intercepting rack, which compelled all migrating salmon to pass through narrow tunnels or gates provided for the purpose and so arranged that the fish would be readily visible to persons on watch.

Men provided with an automatic counting and registering device were stationed on the rack night and day and kept a tally of the salmon as they passed upstream. The run continued during all of July and part of August, and on one day over 324,000 fish were recorded, and on another more than 402,000. The total tally was 2,603,655 salmon, all of the red species.

These were fish that had escaped the very active fishing in Nushagak Bay, and in addition to them several million other fish are known to have gone up other tributaries of the bay to their spawning grounds, the data available indicating that the total run of red salmon in the Nushagak basin in 1908 was as many as 13,600,000, with 10,100,000 as the minimum, of which 6,400,000 were caught and utilized at the local canneries.

Therefore, under the most favorable conditions for reproduction, nearly 53 per cent of the run escaped, and under the most unfavorable 37 per cent.

During each of the three following years the rack was reconstructed at the same place, and the census of the run was taken in the same way, with the following results: 1909, 893,244 fish; 1910, 670,104 fish; 1911, 354,299 fish. Arrangements have been made to continue the count in 1912, which will be a most important year for the experiment, because affording an indication of the approximate number of fish resulting from the run of 1908.

It is yet too soon to say what this experiment will lead to, but it is the expectation that it and similar trials in other streams will afford accurate data relative to the natural increment of the fish, so that, the approximate size of the run being known, the minimum number of fish necessary to maintain the supply may be allowed to pass to the spawning grounds each year and the remainder of the run placed at the disposal of the fishermen.

IMPORTANT NOTES FOR MEMBERS

The splendid picture of "The Matterhorn," which is published as a supplement to this number, shows the magnificent mountain in its grandest and most impressive aspect. For the convenience of members of the Society a limited edition of the picture has been printed on heavy artist's stock, suitable for framing. Copies may be had, unfolded, for 50 cents each, postpaid.

Members desiring the address of the Magazine changed for the summer months are requested to send notice of the desired change immediately.

Dr. Hiram Bingham has directed our attention to a misprint in the recently published account of his explorations in Peru, as follows: In the quotation from Professor Lull's article, through a clerical error, Dr. Bingham's name was substituted for that of Professor Bowman (first column, line 44, page 417, April, 1912, number).

On page 427 of this number read "Kenai Peninsula" for "Seward Peninsula."

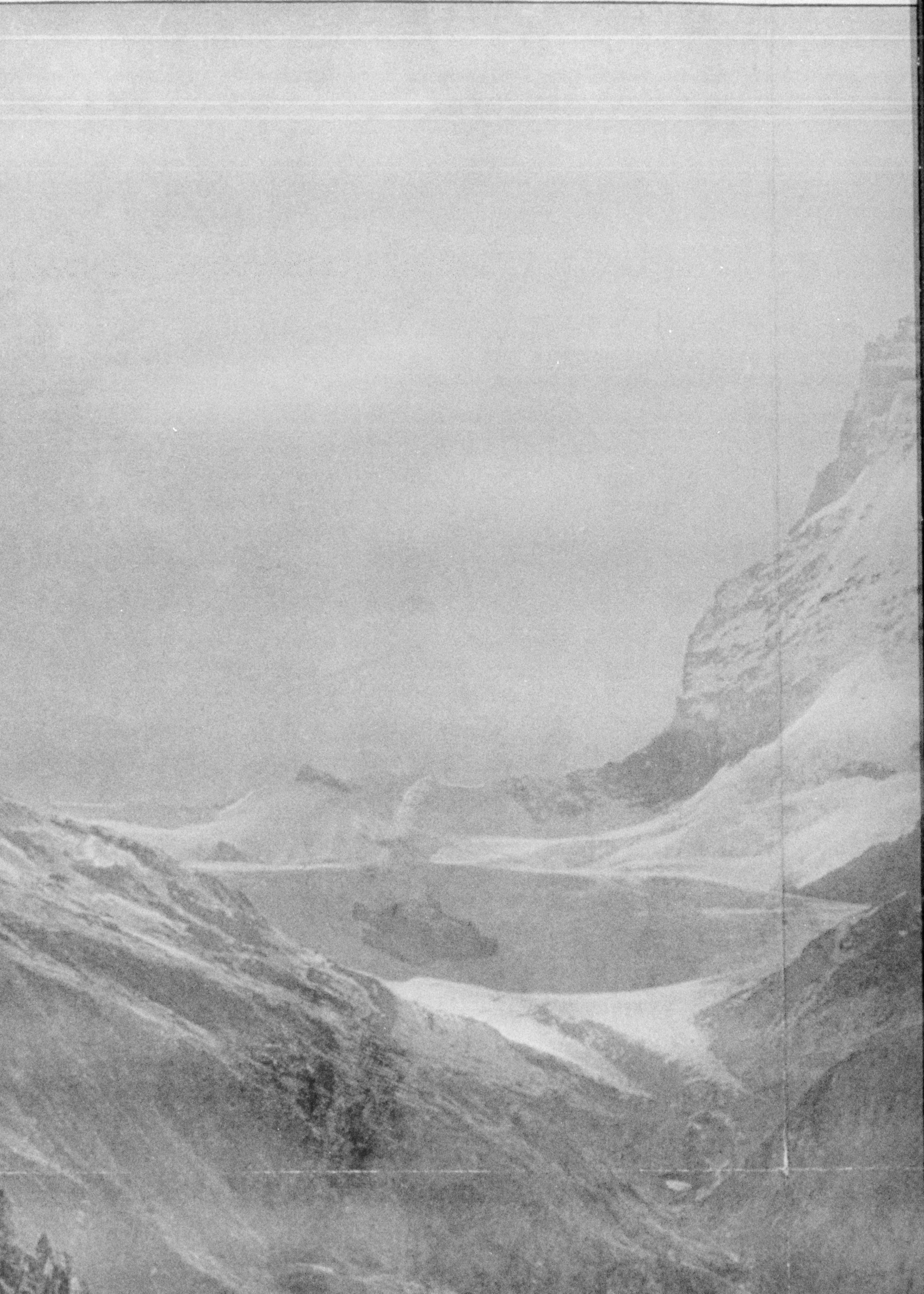

Photo by Abraham

THE MAJESTY OF THE MATTER

AJESTY OF THE MATTERHORN

Copyright by National Geographic Magazine, 1912.—Gilbert H. Grosvenor, Editor

SEED FARMS IN CALIFORNIA

By A. J. Wells

IN 1820 a seed merchant of Philadelphia announced that he had "an abundant supply of seeds," having received from England "300 bushels of garden peas and 400 pounds of onion seed!" Today a single seed farm in California will grow enough onion seed in one field to supply 600 such stores, and one seed merchant will take it all. A single seed-house in Philadelphia now provides floor space equivalent to the area of 16 acres, and such a house will contract with growers in California to furnish seed by the ton and by carload lots of from one to six cars.

Seed-growing has become an established branch of California horticulture, and from these farms the principal seed-houses of the United States and of many parts of Europe draw their supplies.

Seedsmen from half the world visit California yearly to inspect the fields and to arrange contracts, and seeds now go in car lots even to France and to Holland.

Flower and vegetable seeds are generally small, delicate, thinly cased, easily affected by changing weather, injured by dampness, and hard to cure where climatic conditions are unfavorable. Cloudy weather, showers, a driving rain, or heavy wind may, as Shakespeare says, "destroy six months' good hope." But here seeds are grown in a maximum of sunshine and matured without storms or rain or artificial irrigation, faring much as a wild plant fares, save for the constant stirring of the soil. They are cured in the open air, free from all dampness. Harvesting comes on before the rain sets in, and there is no difficulty in drying the seed crops in the field, without the expense of providing barns or miles of sheds for shelter.

The crop is grown only for the seed, and cultivation is directed to the conservation of moisture at the root to maintain a steady but not "woody" or luxuriant growth. The climate of the coast region southward from San Francisco for 500 miles is wonderfully equable and full of comfort for the human plant. It is more radiant, genial, equable and rejuvenating than the famous Riviera, with less atmospheric disturbance and variations of temperature, and is ideal for garden and field plants.

There are seed farms in eight counties of the State, but for the most part the business centers in certain coast valleys between San Francisco and Santa Barbara. Of these, the chief and oldest section is the Santa Clara Valley, about San José, and reaching down into the extensions of this valley, locally known as the Hollister and San Juan valleys. The whole valley is shut away from the sea by the Coast Range, but its climate at the same time is modified by the proximity of the sea, and is a blend of the coast air and the warmer and drier air of the interior.

A more marked coast climate is found in the little valley of Arroyo Grande, 200 miles south of San José. This opens directly upon the ocean, but has the temperature of Santa Barbara rather than that of San Francisco. Still further south is the Lompoc Valley, nearly due east from Point Conception, where the coast line turns sharply eastward, exposing the whole frontage of the land to the southern sun, and taking the west winds at an angle.

The soil of the Santa Clara Valley and its extensions is sedimentary, very deep, black or chocolate brown, and rich and moist. Vancouver described it in 1792 as "a rich, productive mold, superior to any I have seen in America."

The soil of Arroyo Grande and of Lompoc is of a lighter color and finer texture, approaching the loess type in appearance, and is enormously fertile. Locally the latter region has been known for its large production of mustard seed and the former for its great vegetable products. A large seed farm is located in the Arroyo Grande, which has this year, on a single contract, 300 acres of sweet peas.

XUM

Photo from A. J. Wells

A FIELD OF SWEET PEAS, MORSE SEED FARM, SAN JUAN VALLEY, CALIFORNIA: "FARMS OF A THOUSAND OR FIVE THOUSAND ACRES ARE CARED FOR LIKE GARDENS"

On the seed farm in Arroyo Grande, onions are carried as "sets" to the head of the valley and planted in the higher and warmer soil for the sake of a better seed crop. So elsewhere growers, after the first year, ship the bulbs to the San Joaquin or the Sacramento valleys for the sake of a different soil and air in which to mature the seed, and to escape the blight, which is at once the bane and problem of growers of this seed in many regions.

The delta lands of the valleys just named are among the richest lands in the world, and are known as the California Netherlands. Onions do well the first year in a heavy black soil. Lettuce wants a heavy loam, as do sweet peas, while the radish seeds more quickly and does better in a lighter soil.

Plowing and preparation of the soil goes on from December to February, and most of the planting is completed before midwinter. Needless to say, the seed-bed is well stirred and the soil made fine. Farms of a thousand or five thousand acres are cared for like gardens. March, April, May, and the early part of June are given to steady cultivation and weeding. Seeds are grown without irrigation, save under extreme conditions, and cultivation is almost continuous, that moisture may be kept near the surface.

Much work must be done with the hoe, and hand-work of several kinds is necessary. Thus, certain kinds of lettuce must have the head slashed with a knife, to let the seed stalks out; onions as "sets" must be placed one by one right side up in the row and covered; celery, before being set out in the field, is twice transplanted; and carrots and

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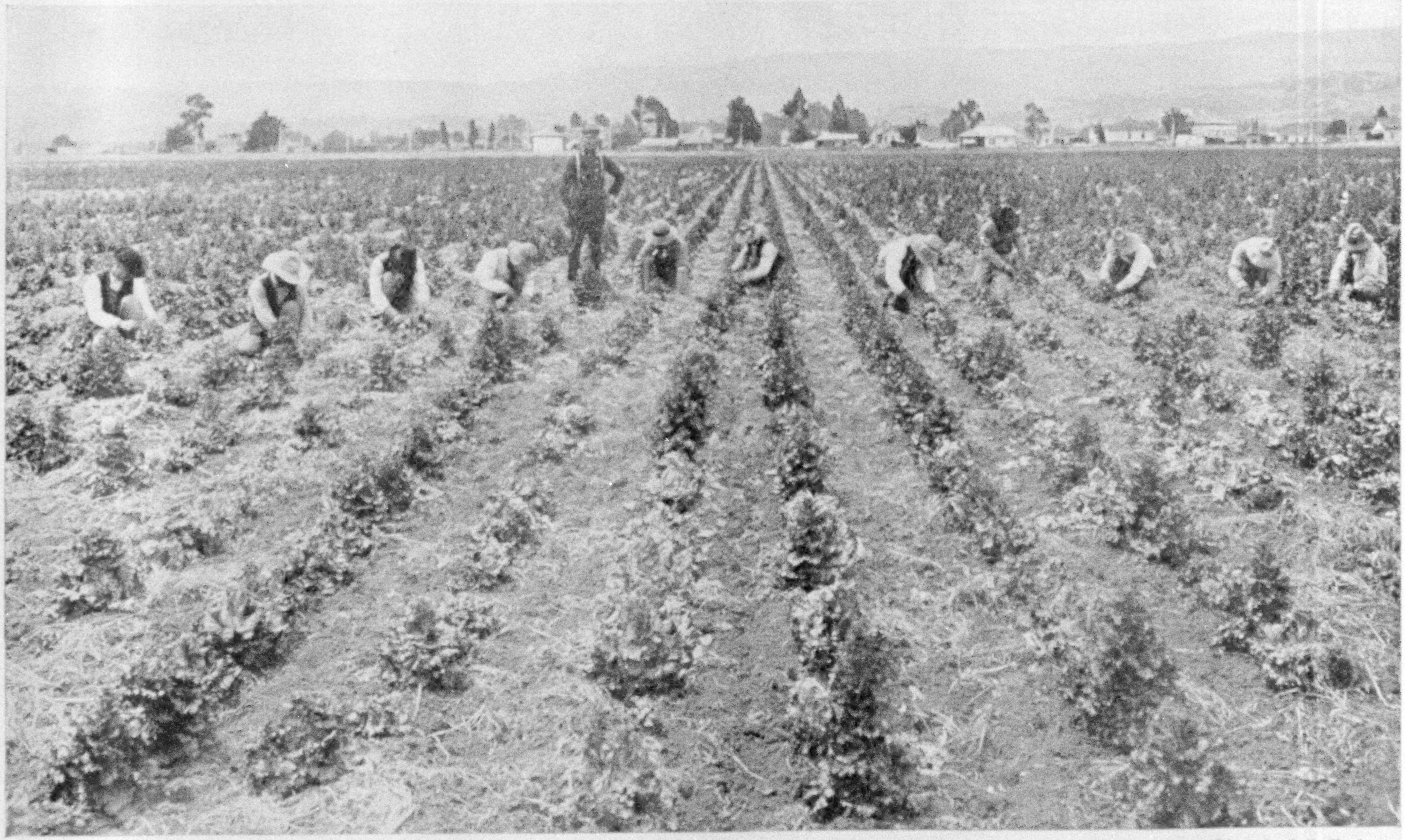


Photo by J. O. Tucker

STRIPPING LETTUCE OF DEAD LEAVES: ON A SEED FARM, GILROY, CALIFORNIA

Certain kinds of lettuce must have the head slashed with a knife to let the seed stalks out (see page 516)

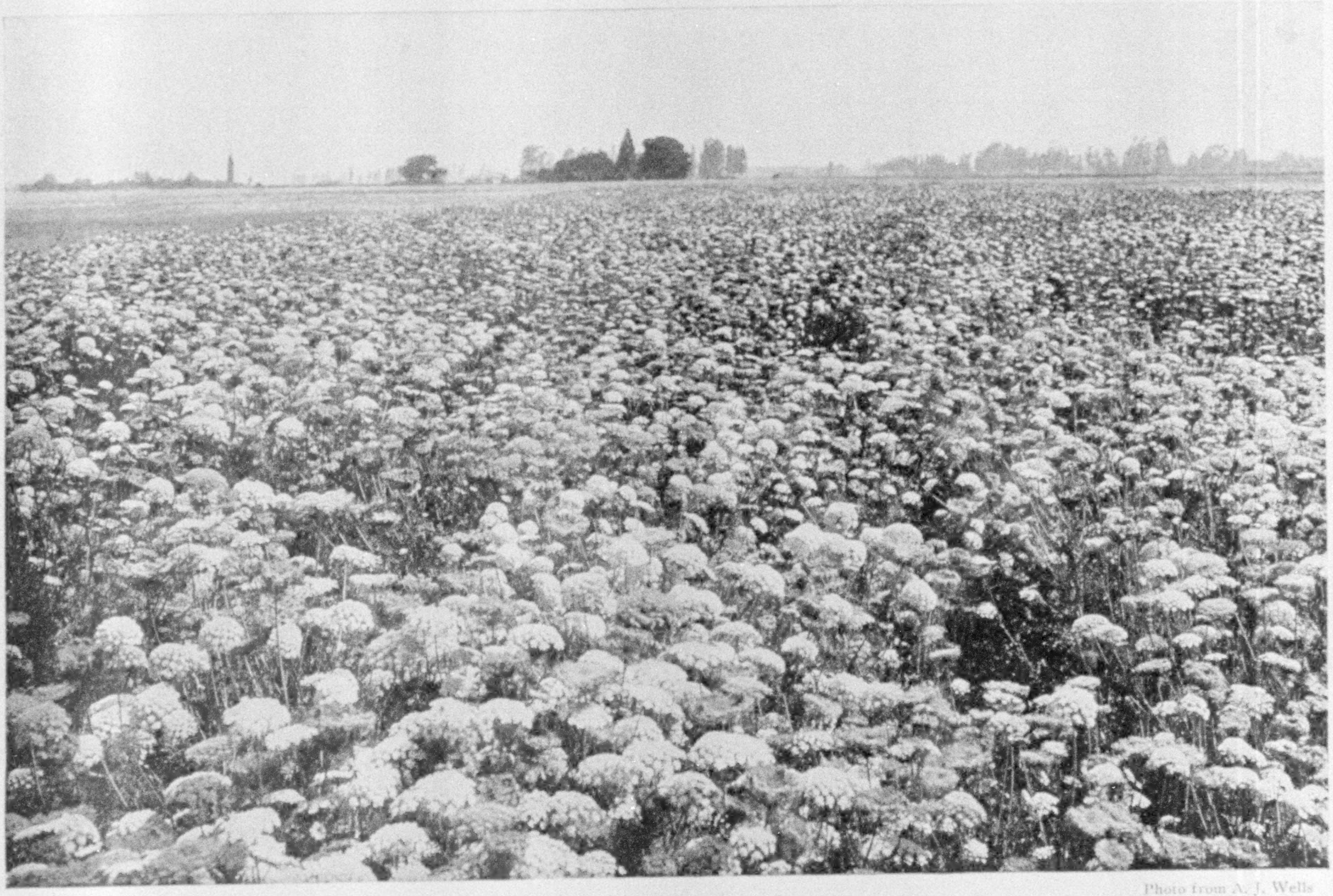


Photo from A. J. Wells

A FIELD OF CARROTS IN BLOSSOM: ON A BIG SEED FARM IN THE SANTA CLARA VALLEY, CALIFORNIA

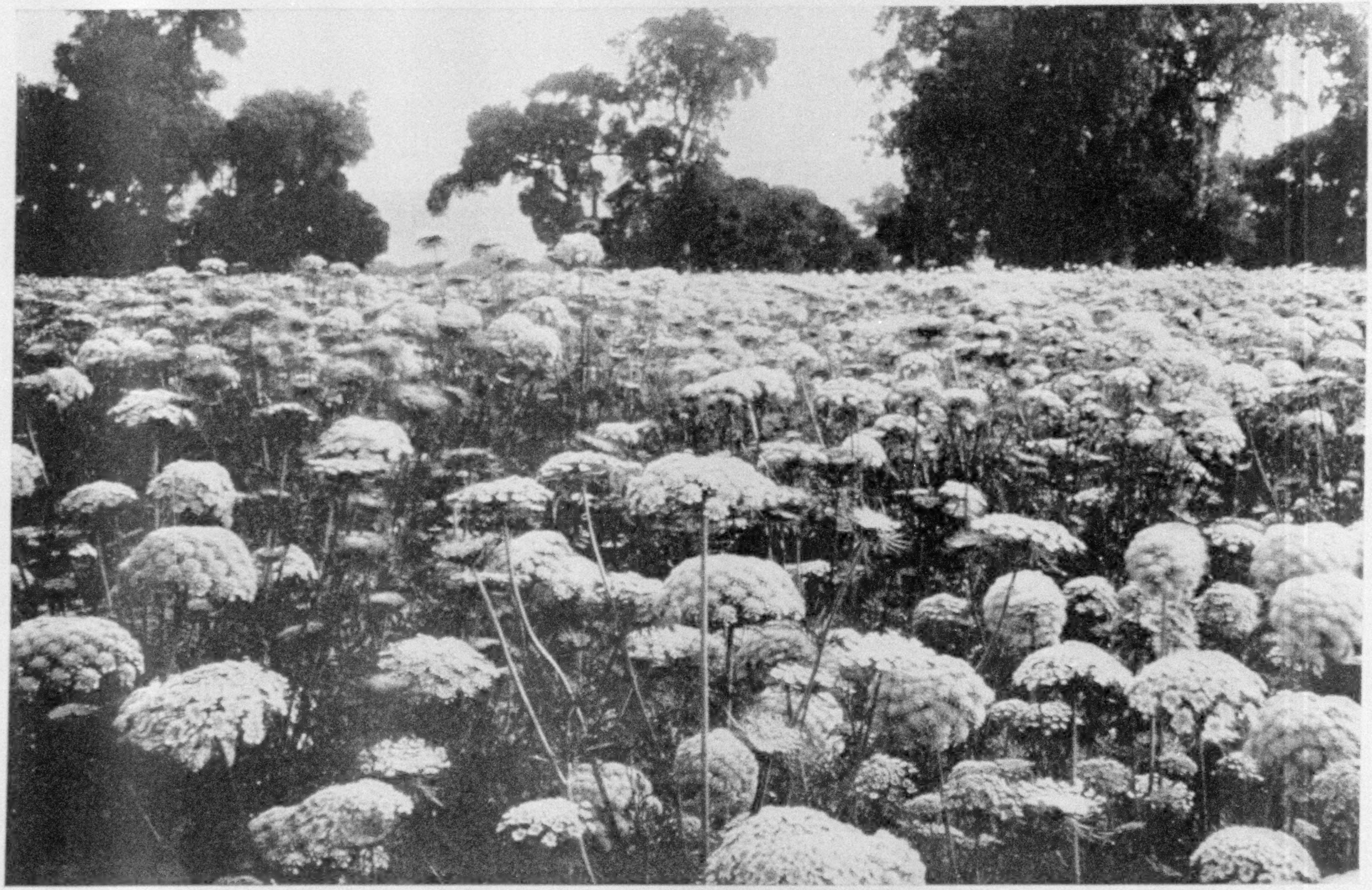
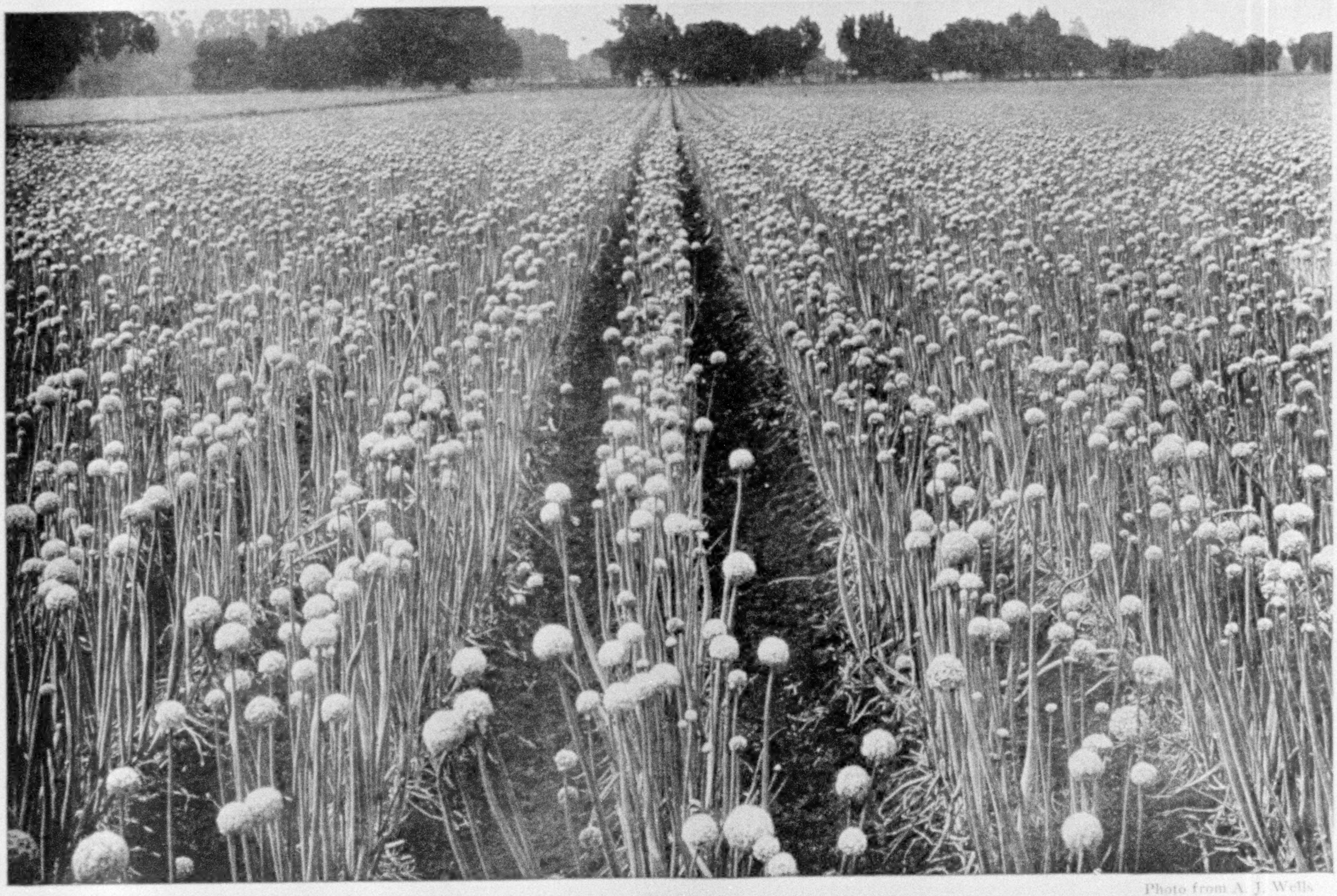


Photo from A. J. Wells

A CORNER OF A FIELD OF CARROTS IN BLOOM : SANTA CLARA VALLEY, CALIFORNIA



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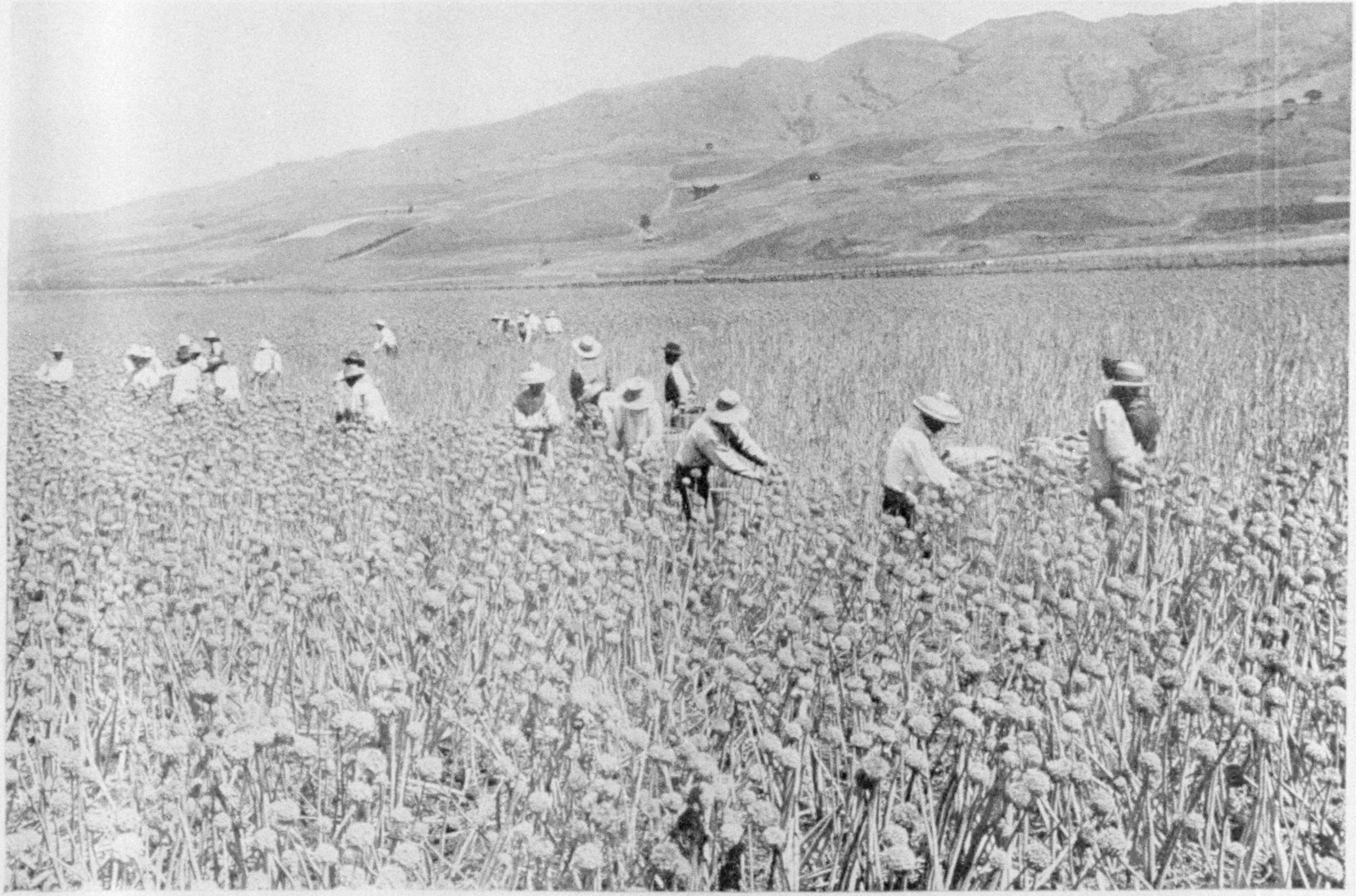
A FIELD OF SEED ONIONS IN BLOOM: IN THE SANTA CLARA VALLEY, CALIFORNIA



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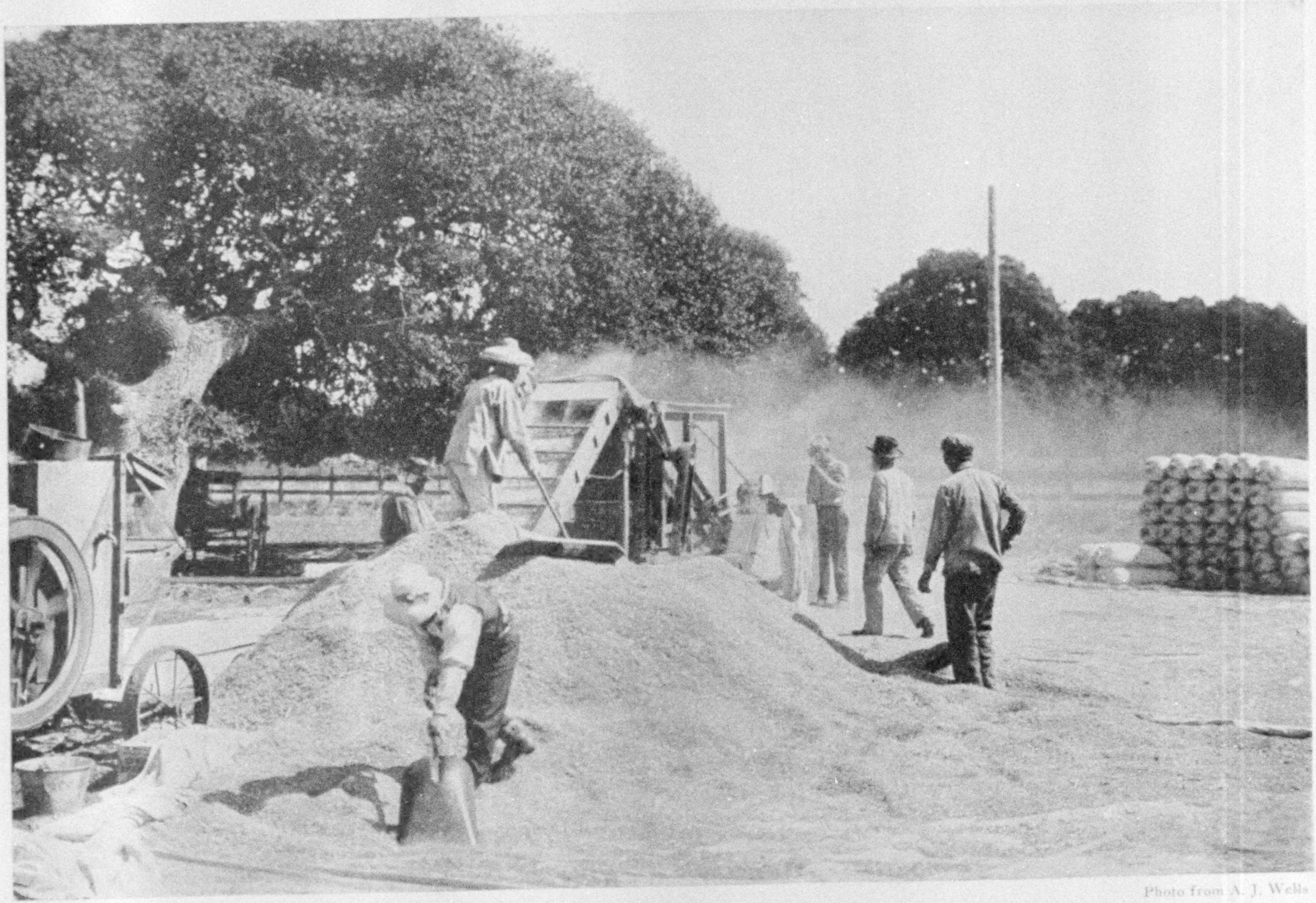
TOPPING SEED ONIONS IN THE SANTA CLARA VALLEY, CALIFORNIA: ONION FIELDS VARY FROM 100 TO 600 ACRES



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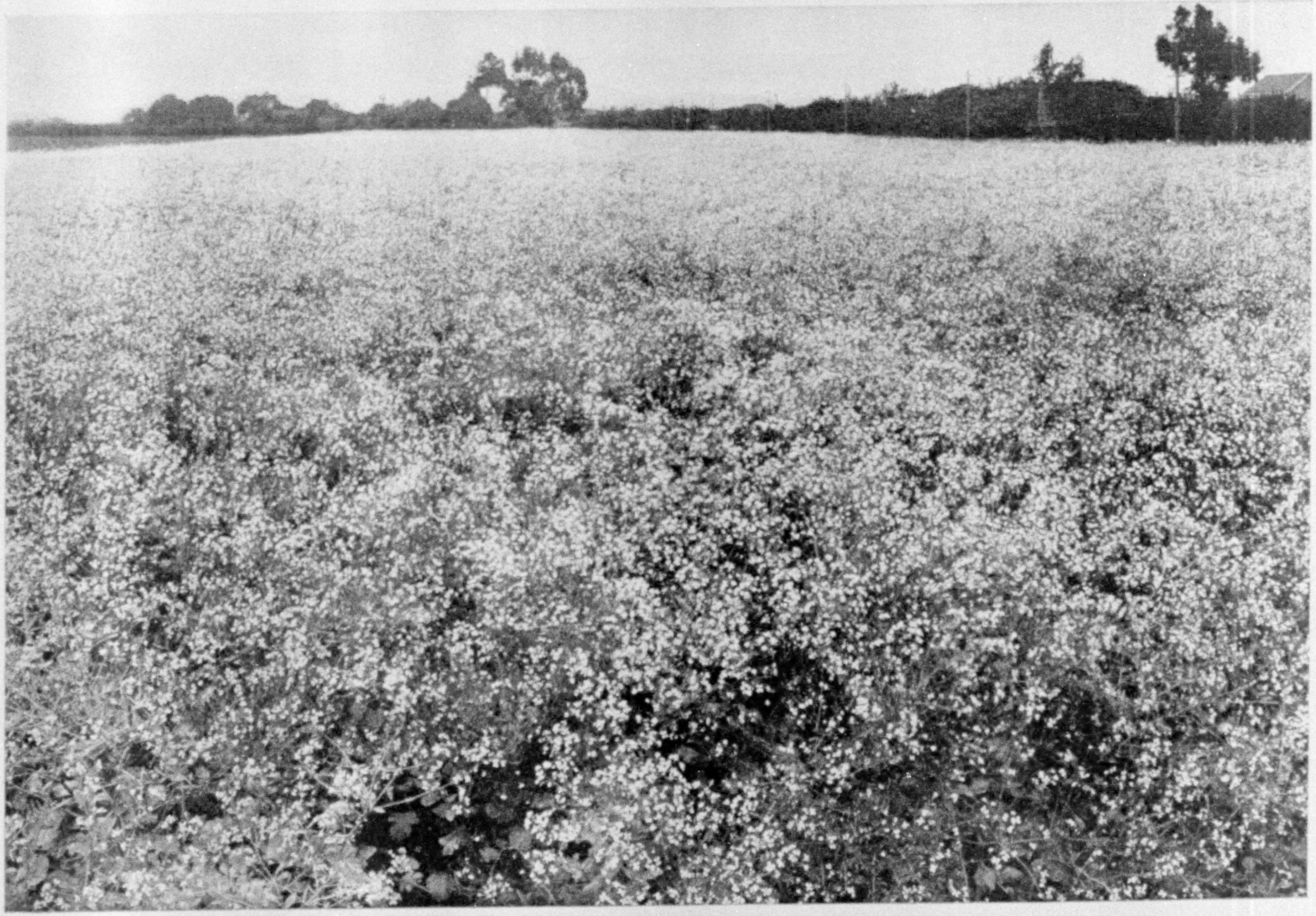
THRESHING ONION SEED IN THE SAN JUAN VALLEY, CALIFORNIA (SEE PAGE 530)



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A FIELD OF RADISH IN BLOOM: SANTA CLARA VALLEY, CALIFORNIA

Photo from A. J. Wells

FIELD OF RADISH IN BLOOM : BRASLAN SEED FARM, SANTA CLARA VALLEY, CALIFORNIA

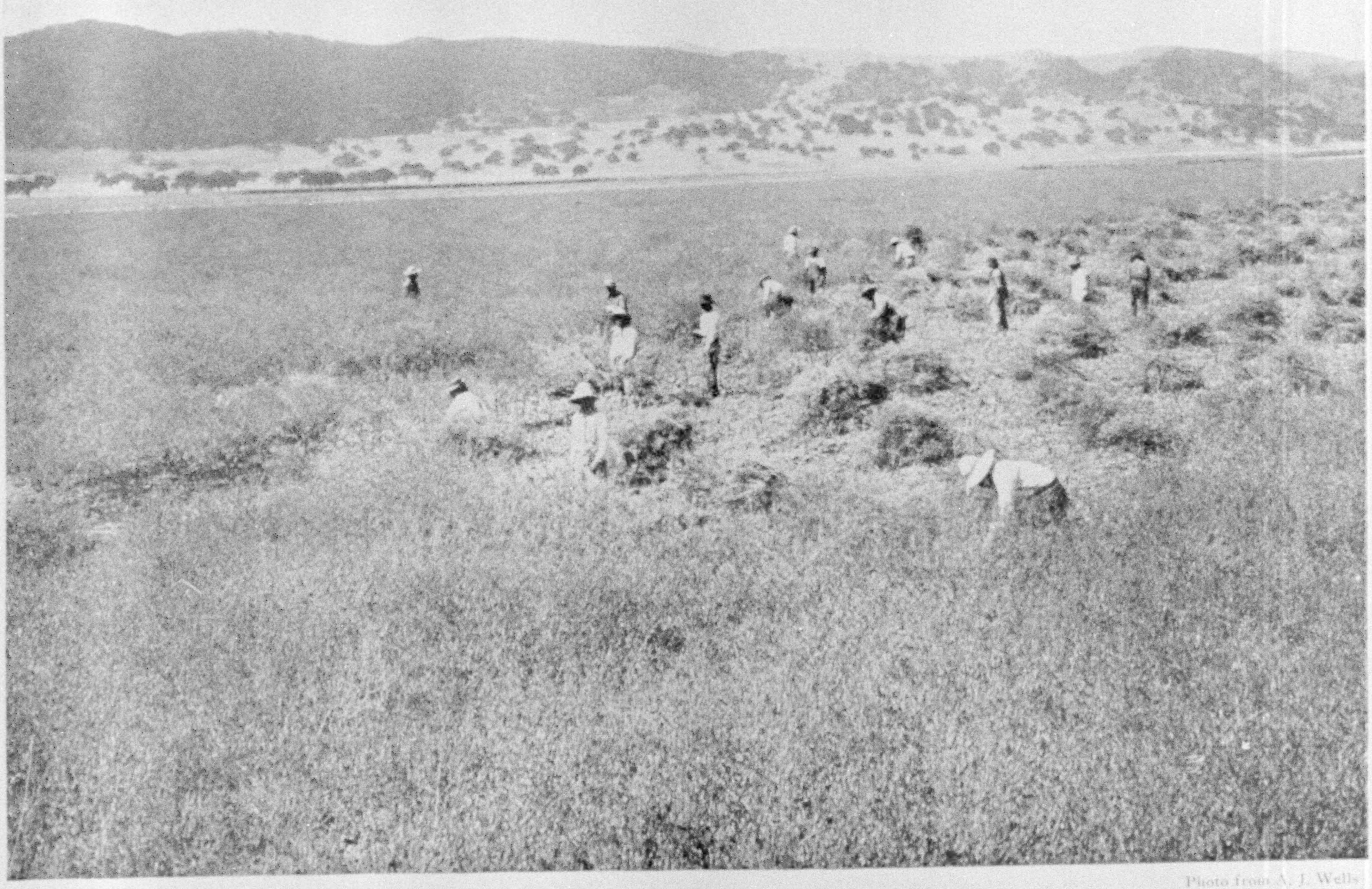

Photo from A. J. Wells

HARVESTING RADISH SEED, SAN JUAN, CALIFORNIA: ALL THE WORK OF HARVESTING MUST BE DONE BY HAND

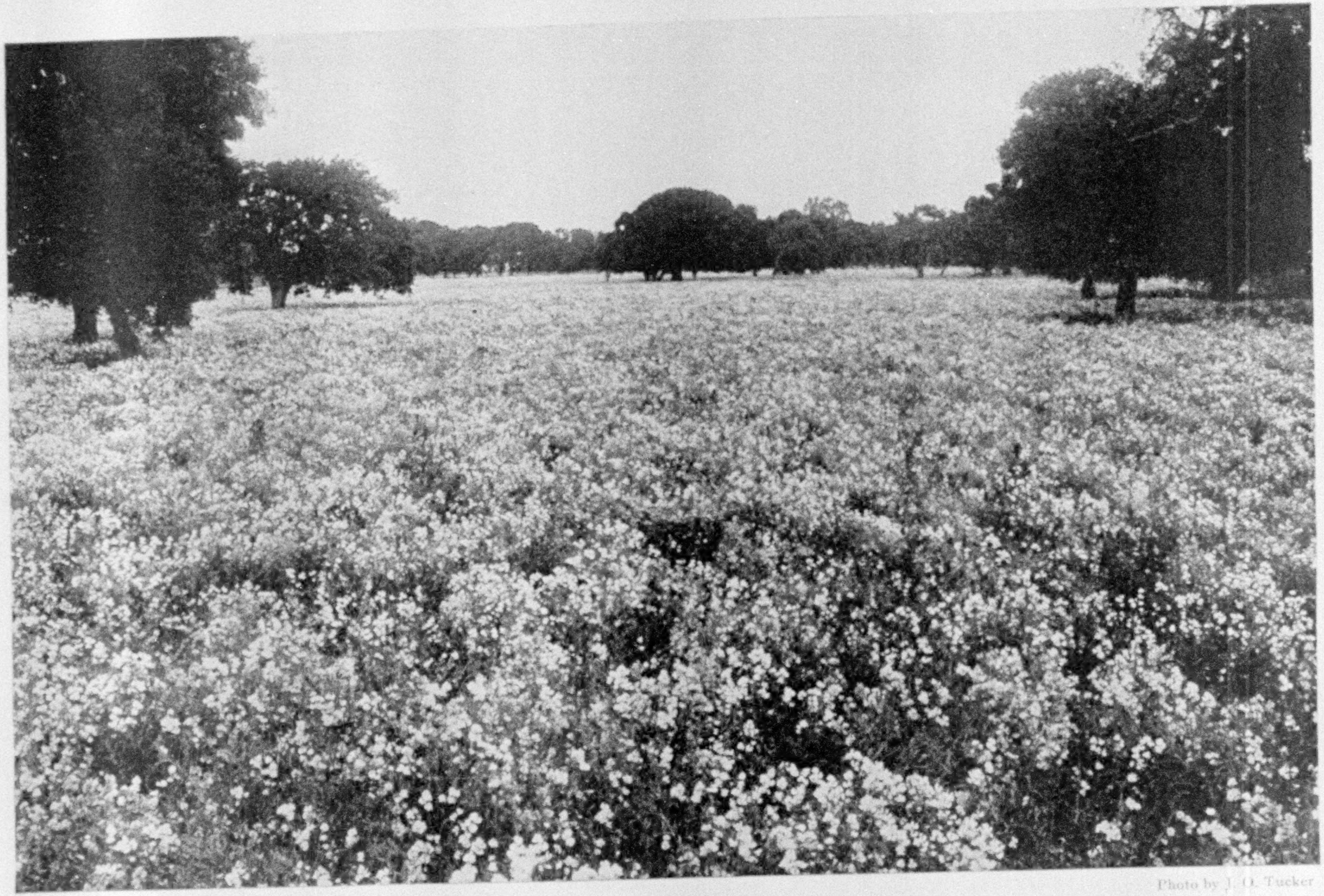

Photo by J. O. Tucker

A FIELD OF SWEET PEAS, 500 ACRES IN EXTENT: SANTA CLARA VALLEY, CALIFORNIA

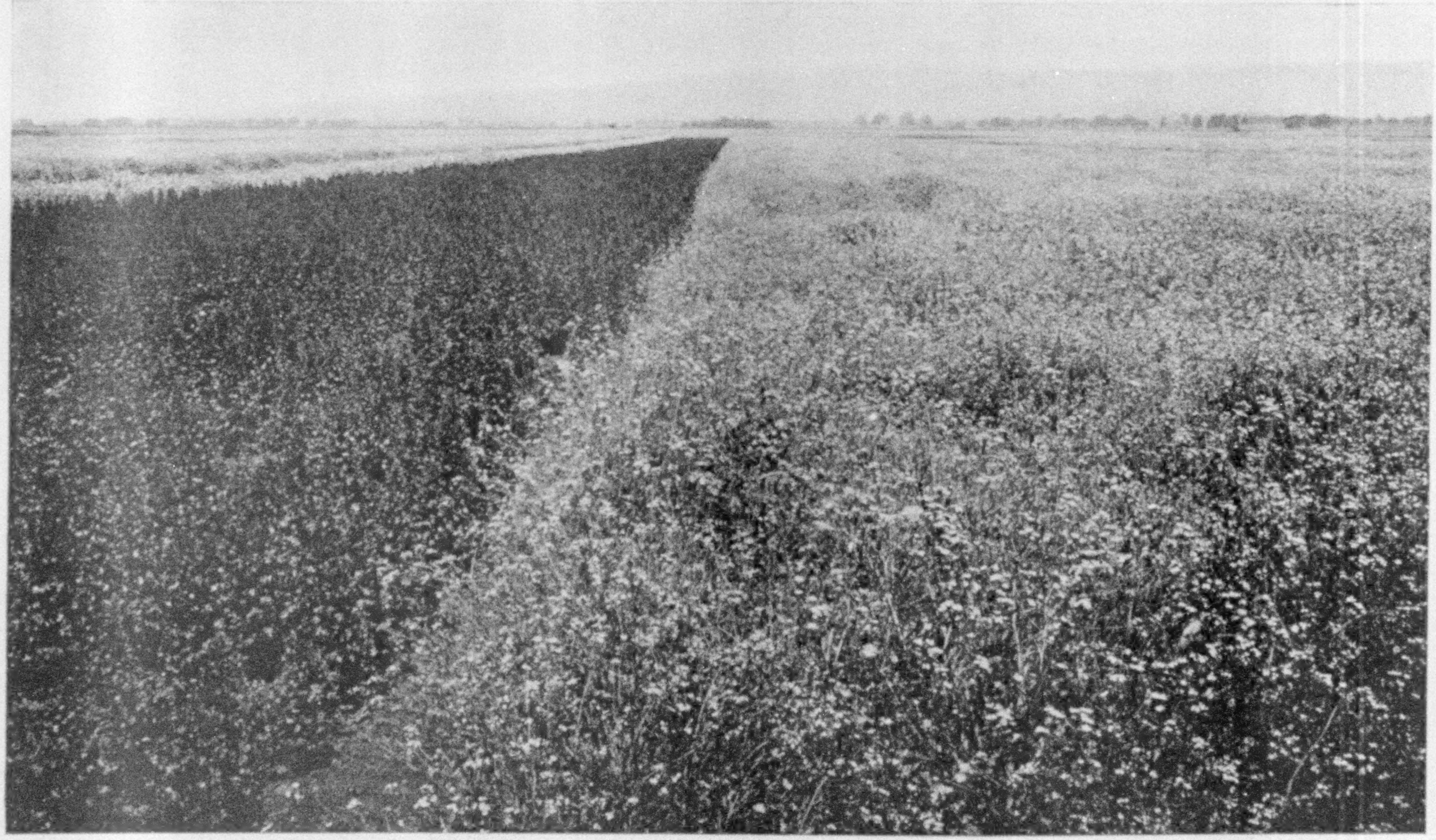

Photo from A. J. Wells

A FIELD OF LETTUCE (ON THE LEFT) AND RADISH (ON THE RIGHT) TWO MILES LONG: NEAR GILROY, CALIFORNIA

Photo by George G. McLean

A CALIFORNIA WILD POPPY FIELD

XUM

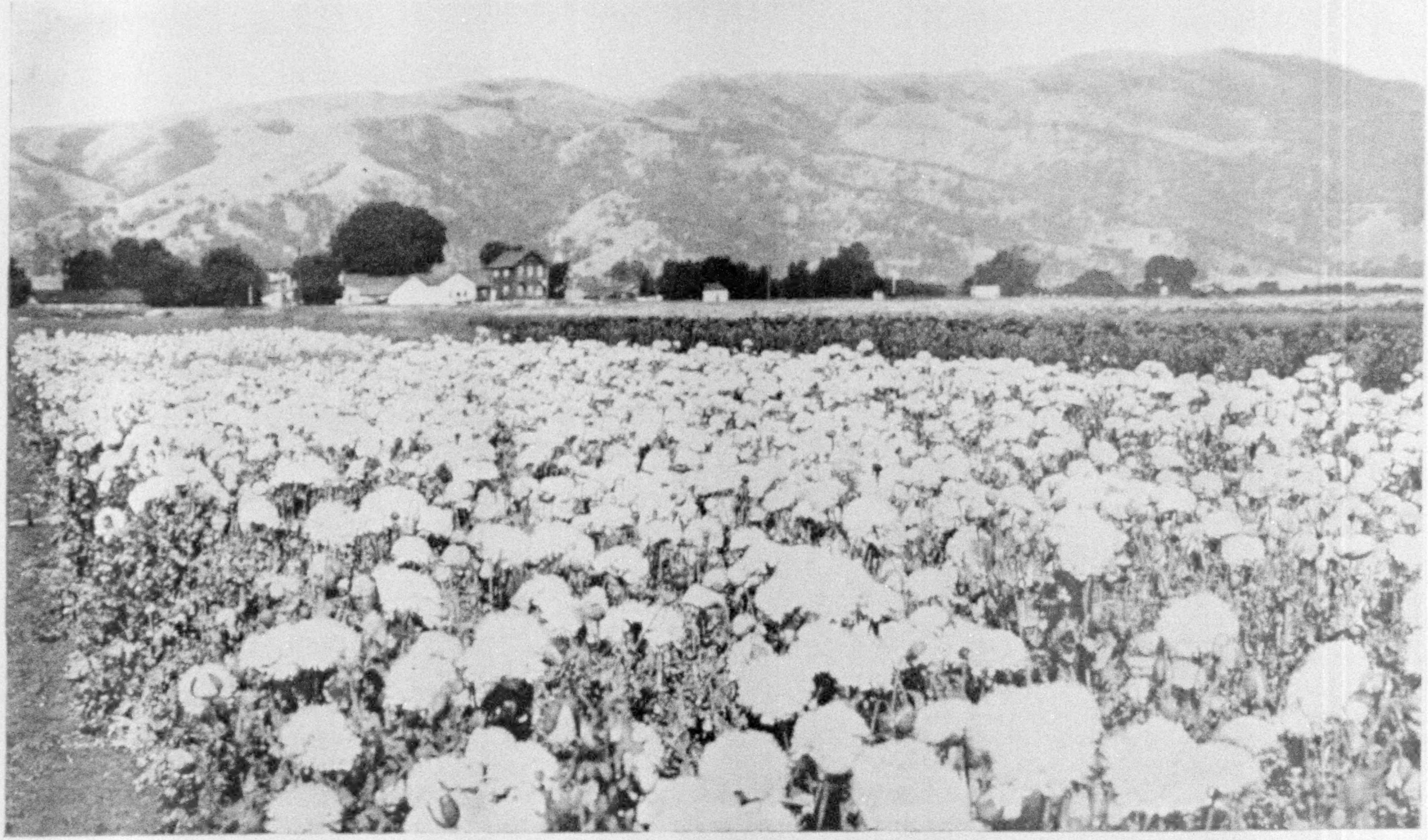

Photo from A. J. Wells

A FIELD OF GIANT WHITE POPPIES; IN BACKGROUND SINGLE RED POPPIES; SAN JUAN VALLEY, CALIFORNIA other roots must be gone over, to eliminate all that are defective in shape or color.

Harvesting is largely hand-work, and runs from July to September, inclusive. Work is all done and seeds are threshed and cured before the fall rains begin. Sweet peas are cut with a mower, and are left in the sun for many days to cure. Onions are topped by hand and hauled to the drying ground, and lettuce must be spread out, turned and dried in the sun.

Threshing is done in a variety of ways: by machinery, by rollers, and by the old hand-flail. Onions are threshed and cleaned by machinery, and the seed is then washed, spread out, and dried, the utmost care being taken to insure purity and cleanliness. Special machinery is used for various kinds of seed, electric power being generally available, the clean seed coming down the prepared chutes, at the mouth of which it is sacked.

The list of seeds grown is long, and the variety of single kinds is surprising. "The majors," as they are called, are lettuce, onions, radishes, and sweet peas. One field of lettuce is shown that is two miles long (page 527), and sweet-pea fields embrace from 100 to 500 acres or more. They yield the most in pounds per acre.

Radishes are grown in large tracts, and nearly a dozen varieties of our common table vegetables produce seed by the ton on several well-known farms.

Flowers are a fashion and the demand for seed is extremely variable, but the list is fairly long and the various bright colors, arranged in parallel rows over a hundred acres—or several times a hundred, if sweet peas are included—make what has been called "a veritable carpet of Paribanon."

The sweet pea holds its vogue year after year, and it is a beautiful sight to see a great field of these exquisite flowers. Where the many varieties are separated by the intervention of some other flower or vegetable, so that the pollen will not mingle, the bands of color gather to a point in the distance, perhaps a mile away, a broad belt of many hues.

In England much enthusiasm is shown in sweet-pea culture, and the National Sweet Pea Society holds, in London, an annual show of immense proportions, exhibiting but this one flower.

In that climate the growers produce remarkable blossoms, but at the expense of the seed, and experts and enthusiasts come yearly to California to inspect the sweet-pea fields, to hunt for novelties, to buy seed, and to write of the industry.

By far the largest part of the sweet-pea seed for the world's planting is grown in California. Here the seed is planted long before the Christmas holidays, and flowers are often at their best by the middle of May. Making but little growth during the colder months, they elaborate a strong root system, and as spring comes on, with its steady warmth, they fairly rush up the trellis and break into bloom.

In the fields the grower must be busy as the season advances. The tendency to variation is constant and demands careful attention. Men are seen up to their waists in flowers, on the lookout for "sports," or natural cross-breeds, and for "rogues," or plants which show a tendency to revert to the original strain. "Roguing," as it is called, is the destruction of all non-typical plants, but "sports" are possible prizes, and are carefully scrutinized, for a fine hybrid may be worth a thousand dollars or more.

The sweet pea will illustrate the difficulty. If "roguing" this year is carelessly done, it will "queer" the next year's crop. Or a "break" in the strain may cost much extra labor.

The "Countess of Spencer" is considered the most remarkable varietal break in floriculture. The type is well defined, but from it has sprung a family of many shades and colors, and it has cost the sweet-pea grower much money and effort to fix the type for trade uses and bring this capricious beauty under the law of descent.

Growers strive, too, to originate fine plants, keeping skillful gardeners at work selecting and hybridizing species, seeking to create new and improved varieties. And in California they have the advantage of a climate that gives vigor to the seed, that stimulates the growth of the plant, and anticipates the efforts of the seed-farmer to produce reliable seeds and improved types of vegetable and flower.

XUM

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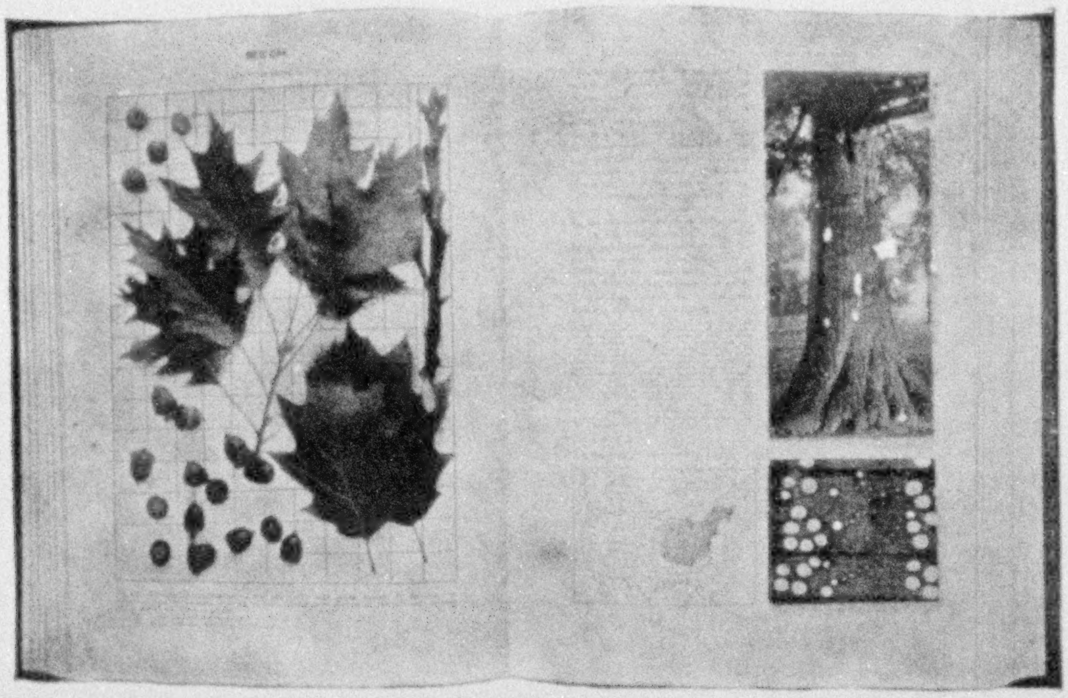

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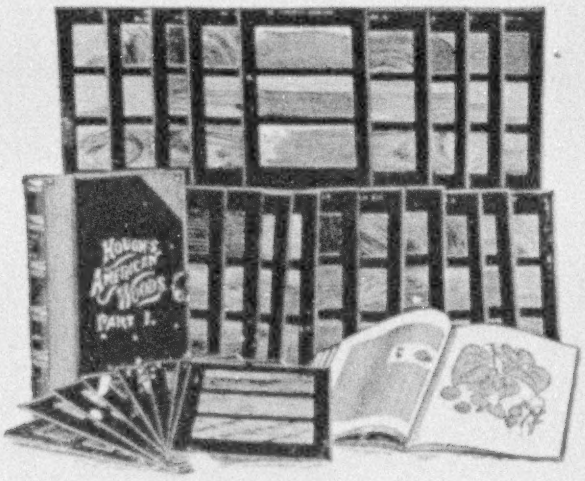

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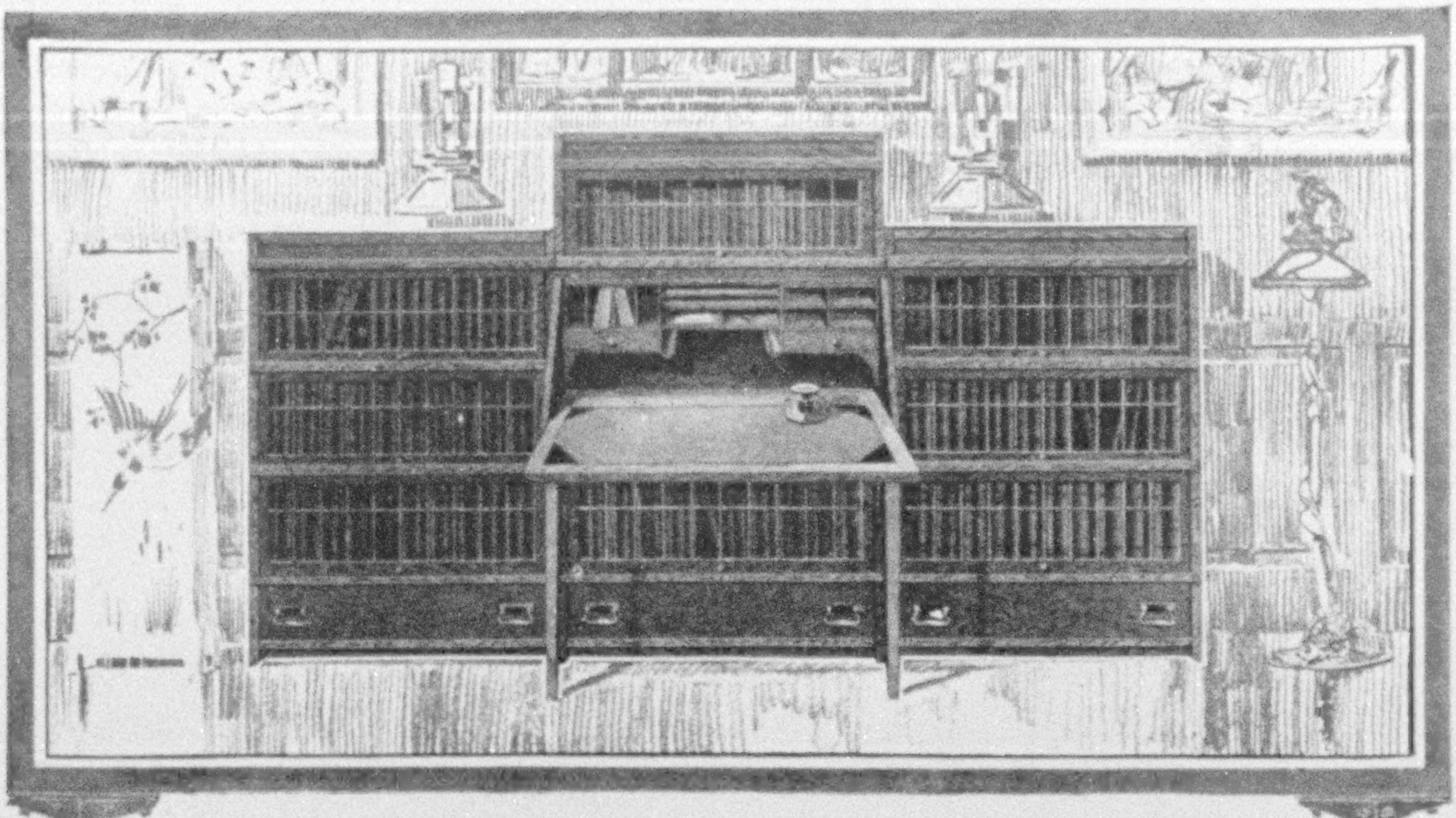

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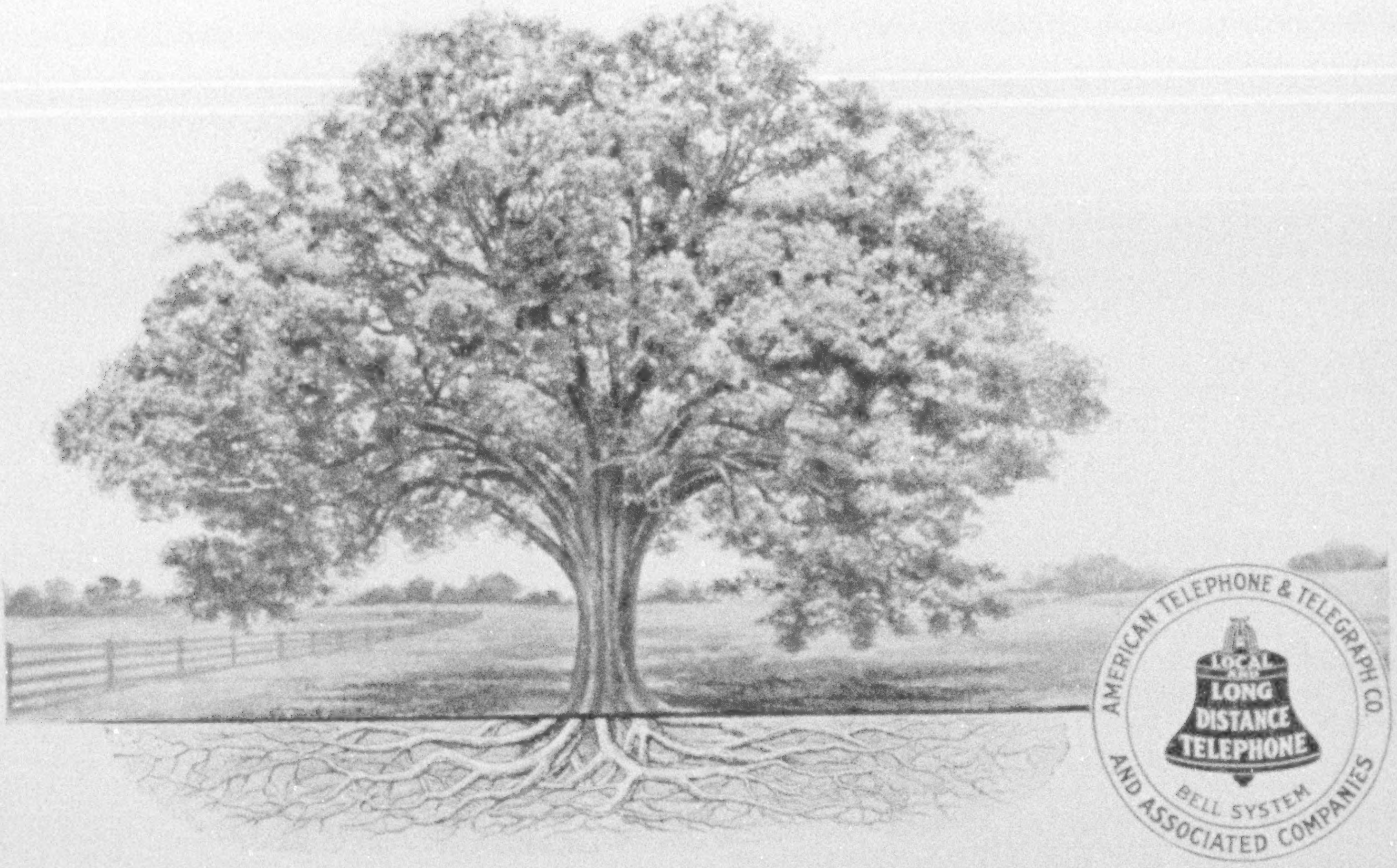
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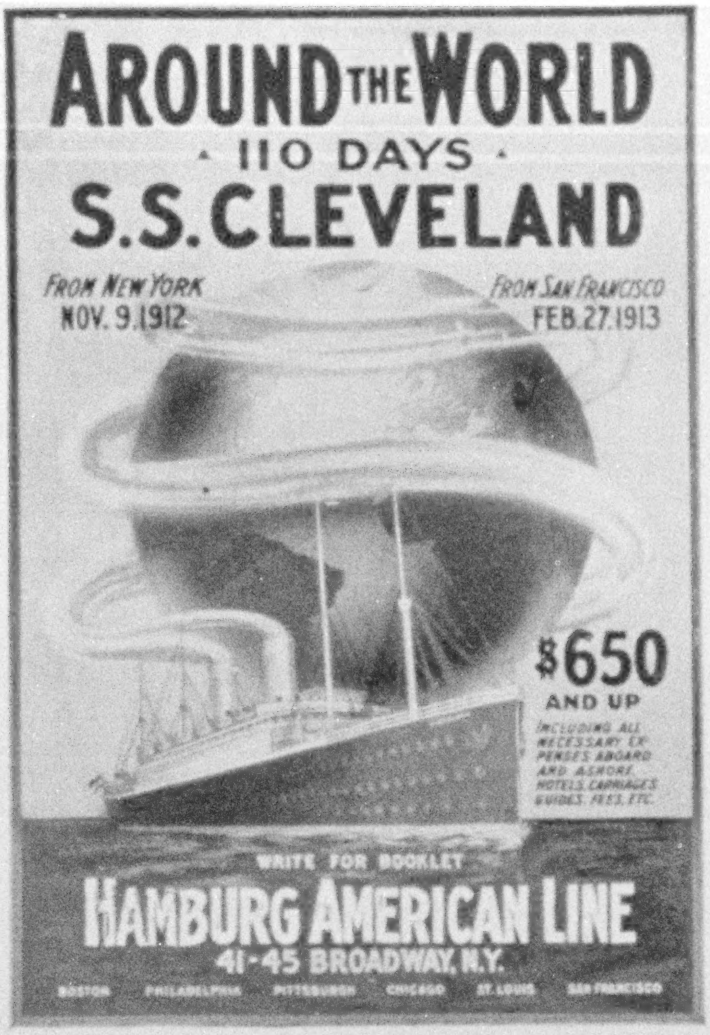
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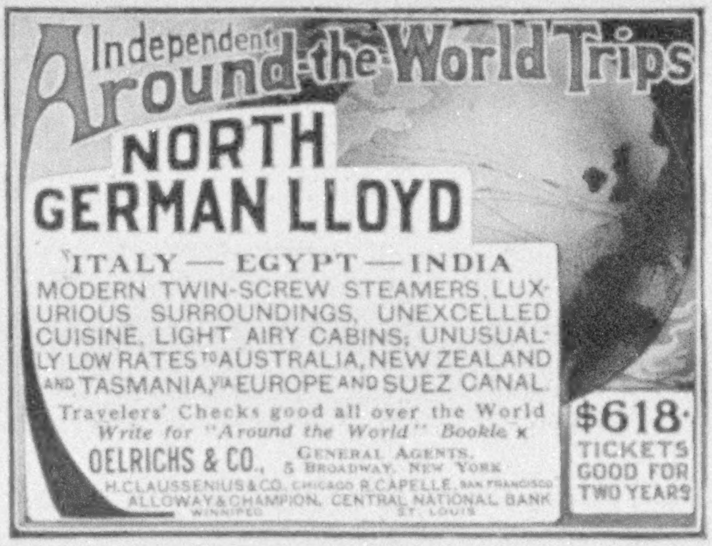
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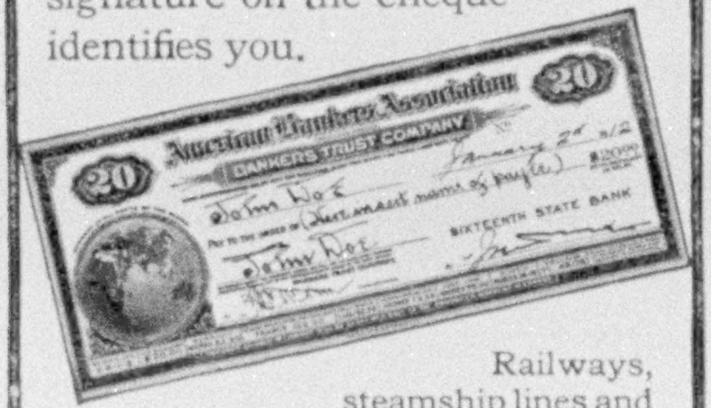
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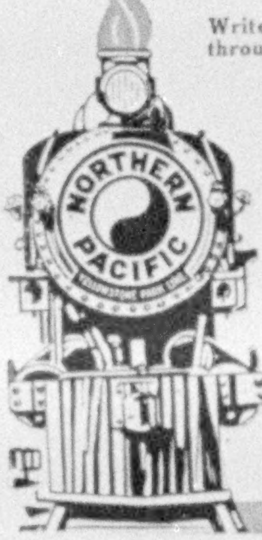

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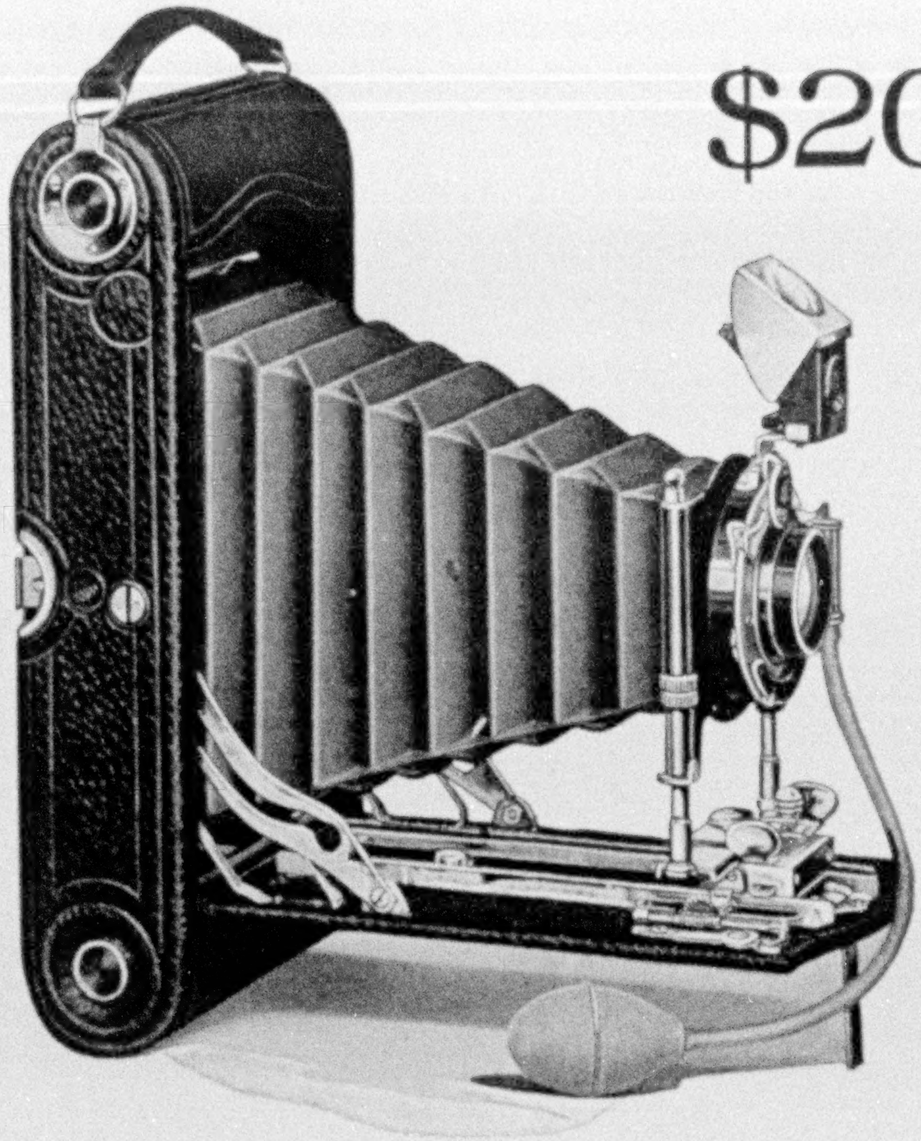

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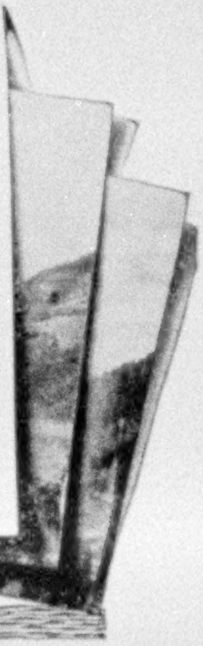

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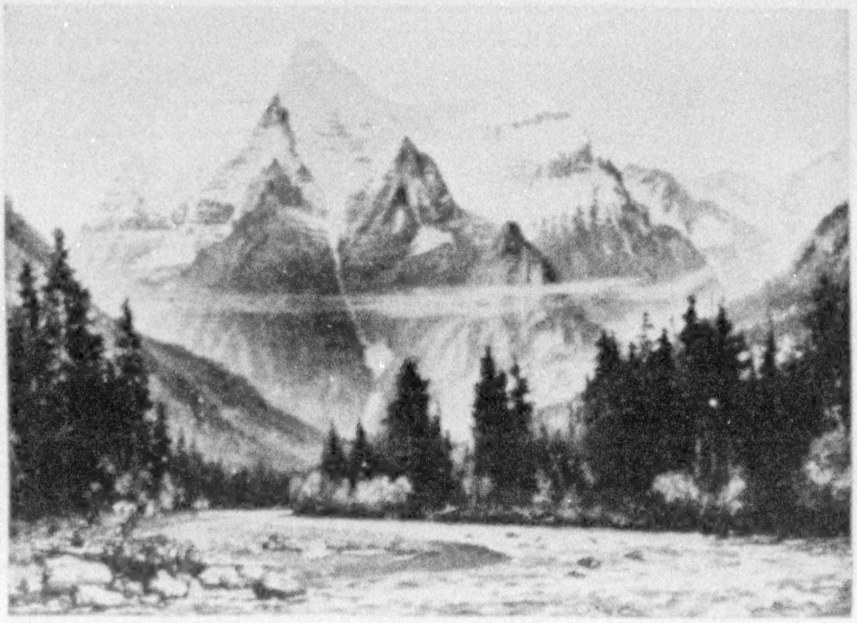

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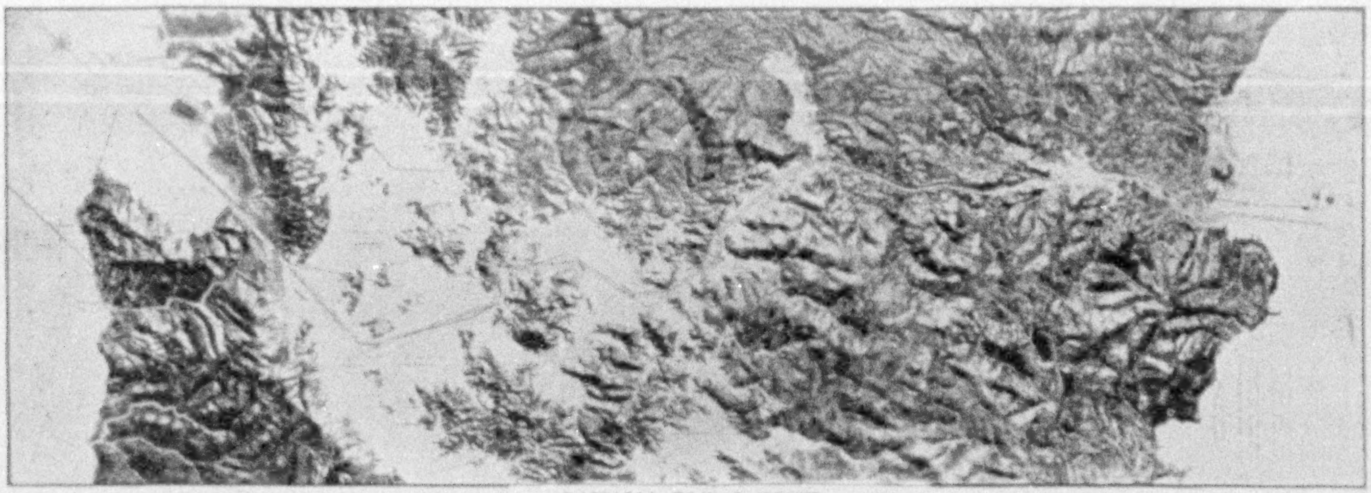

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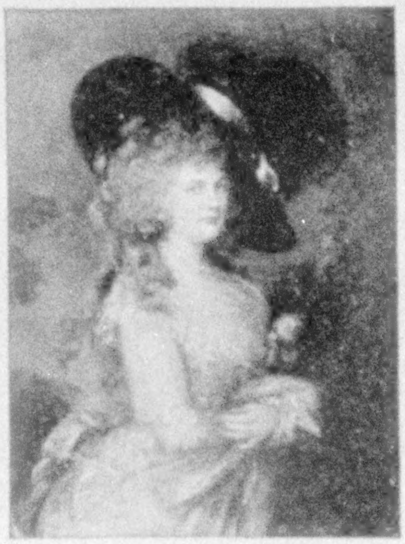

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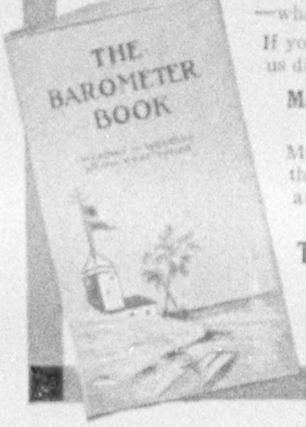

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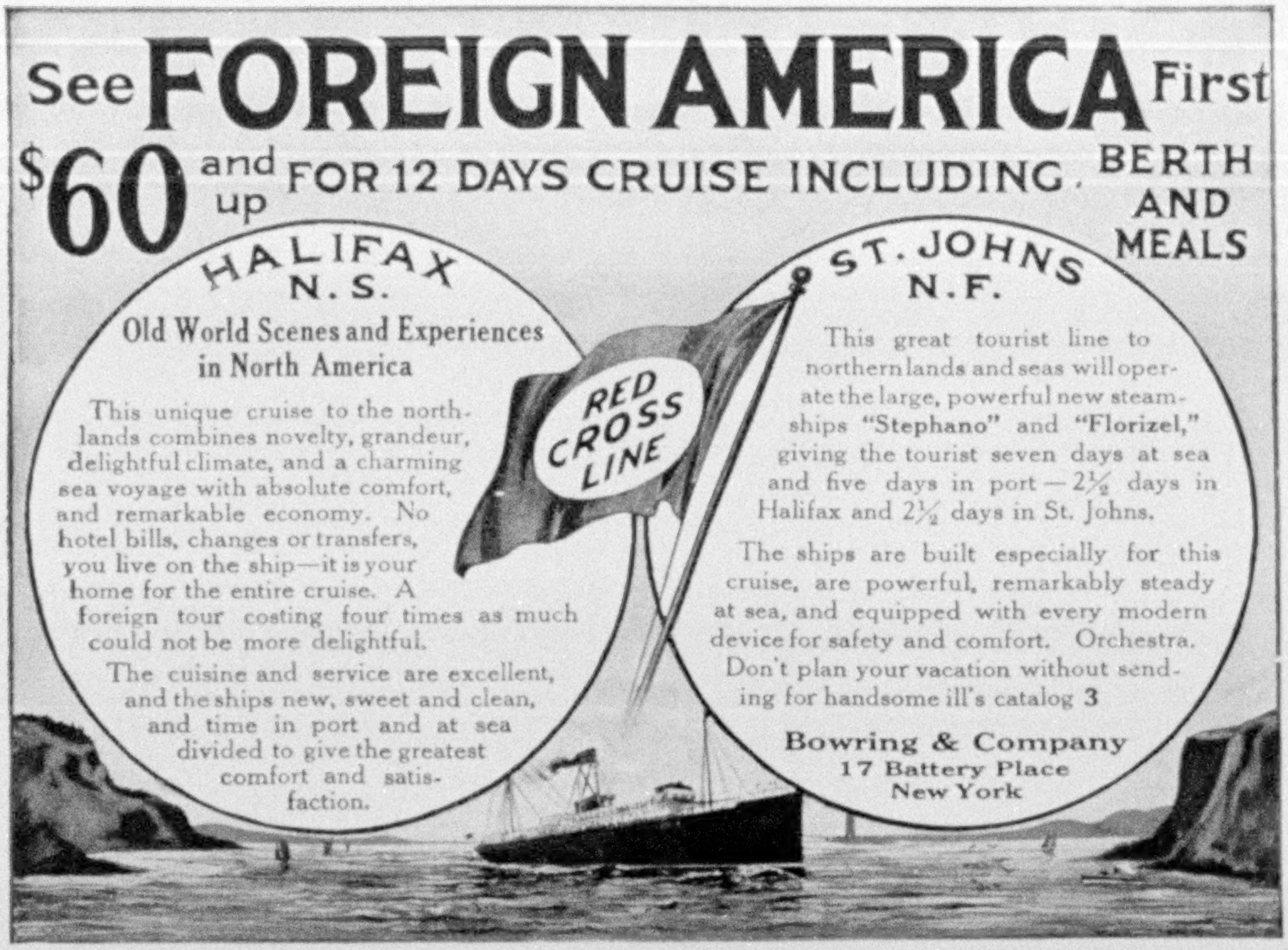

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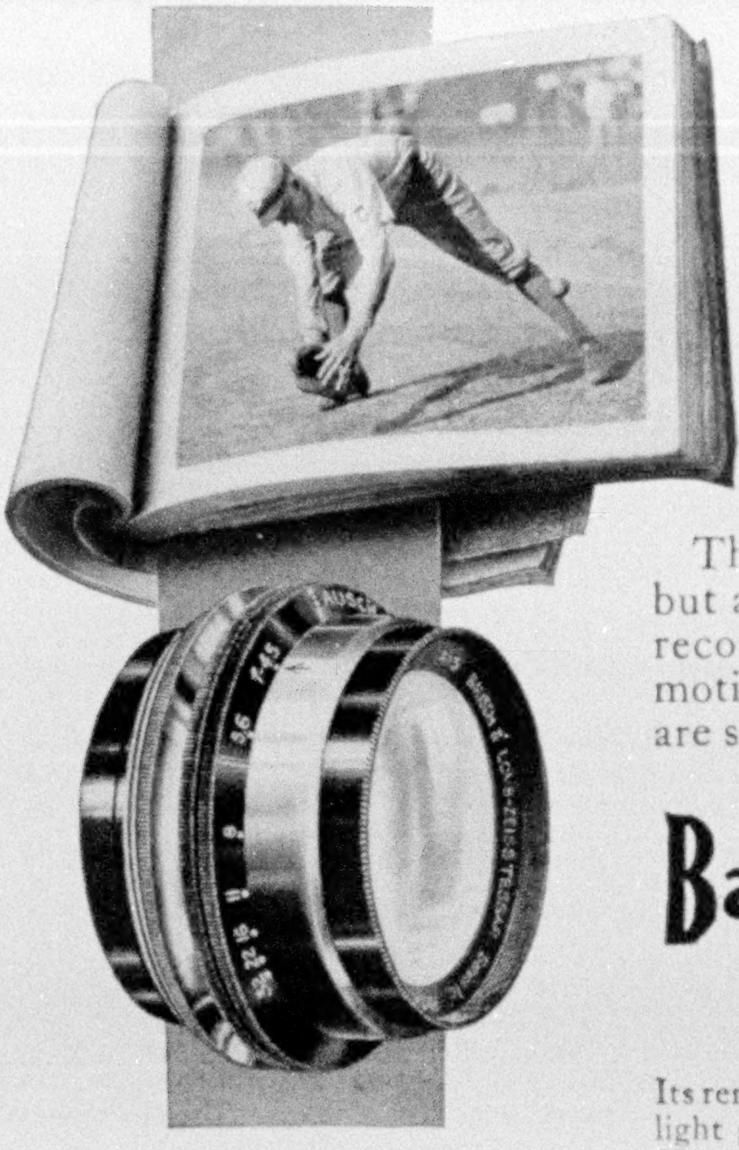

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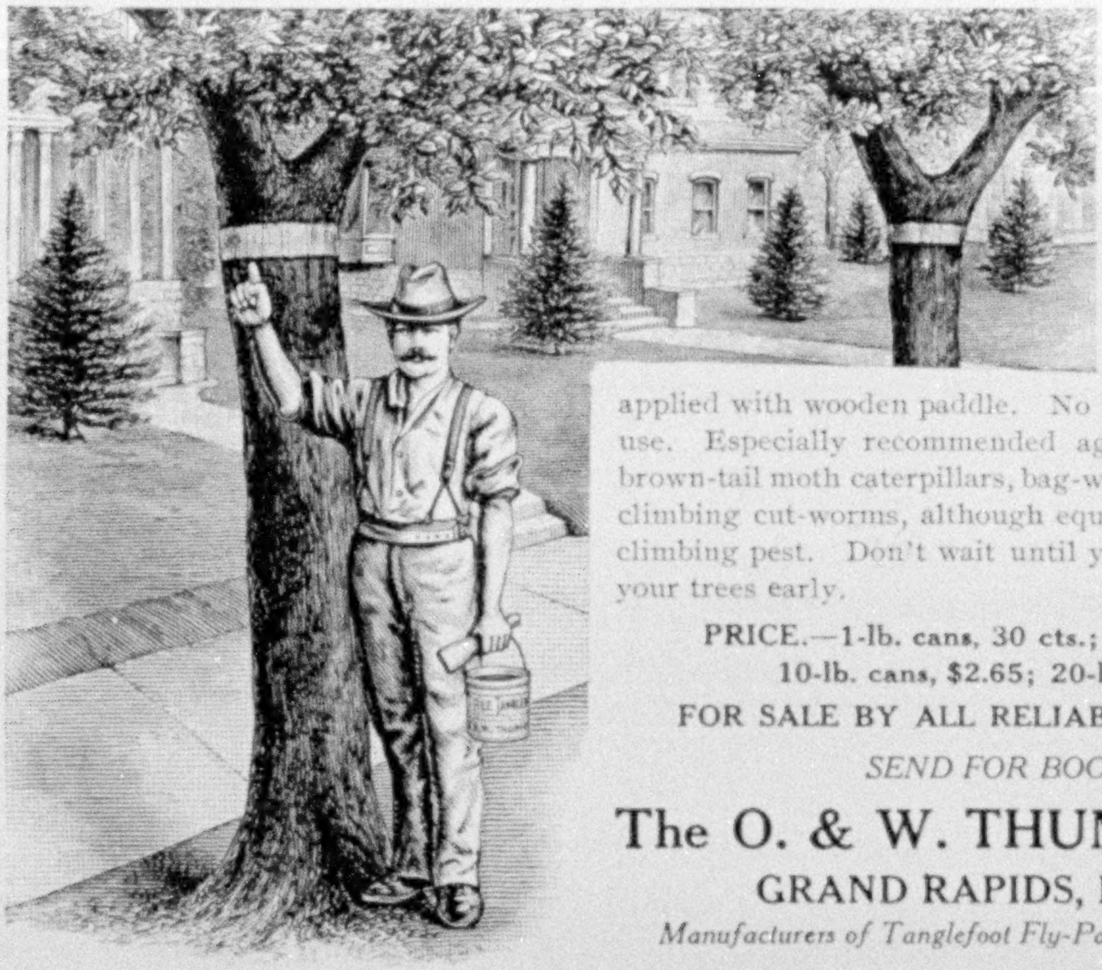

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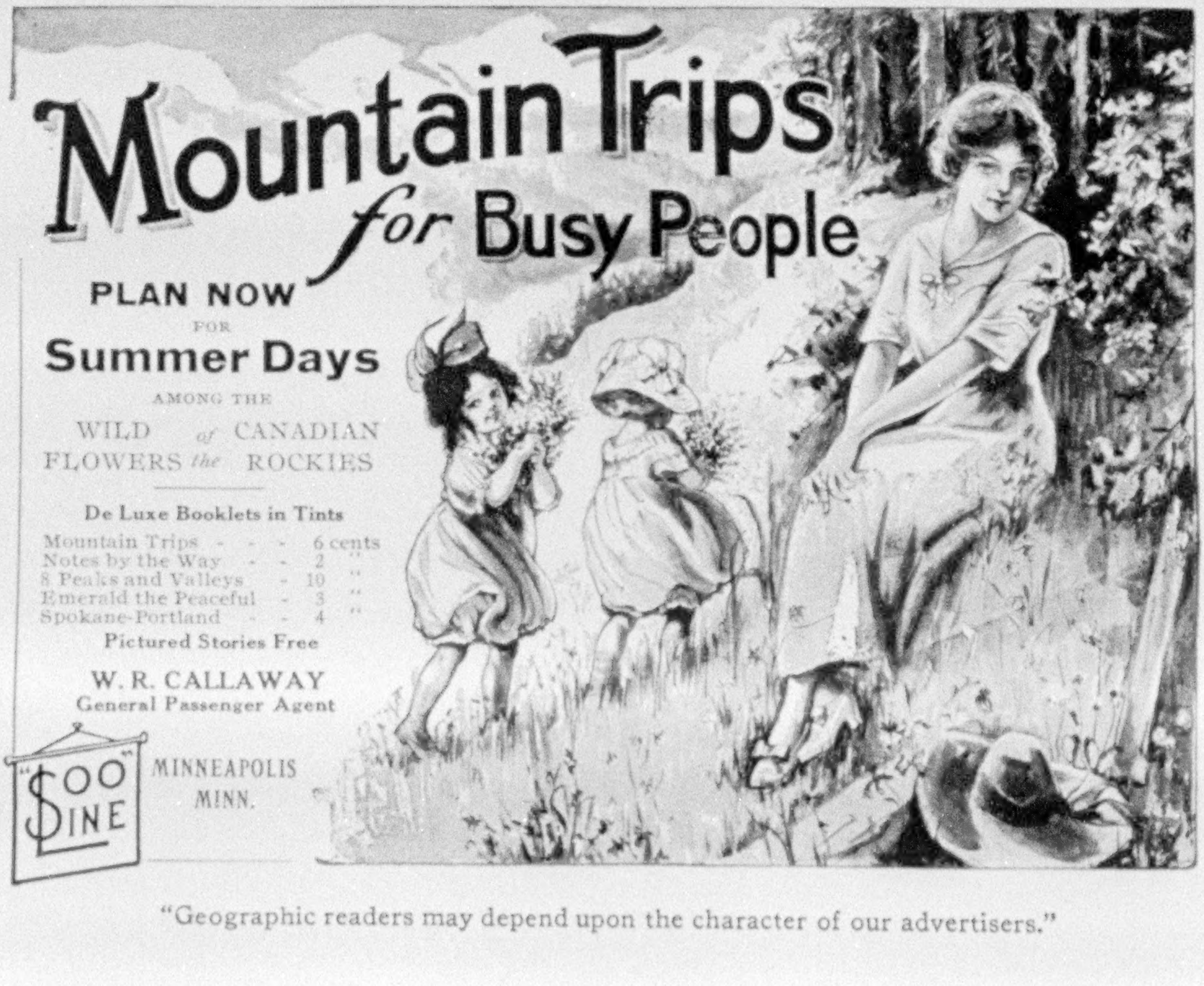

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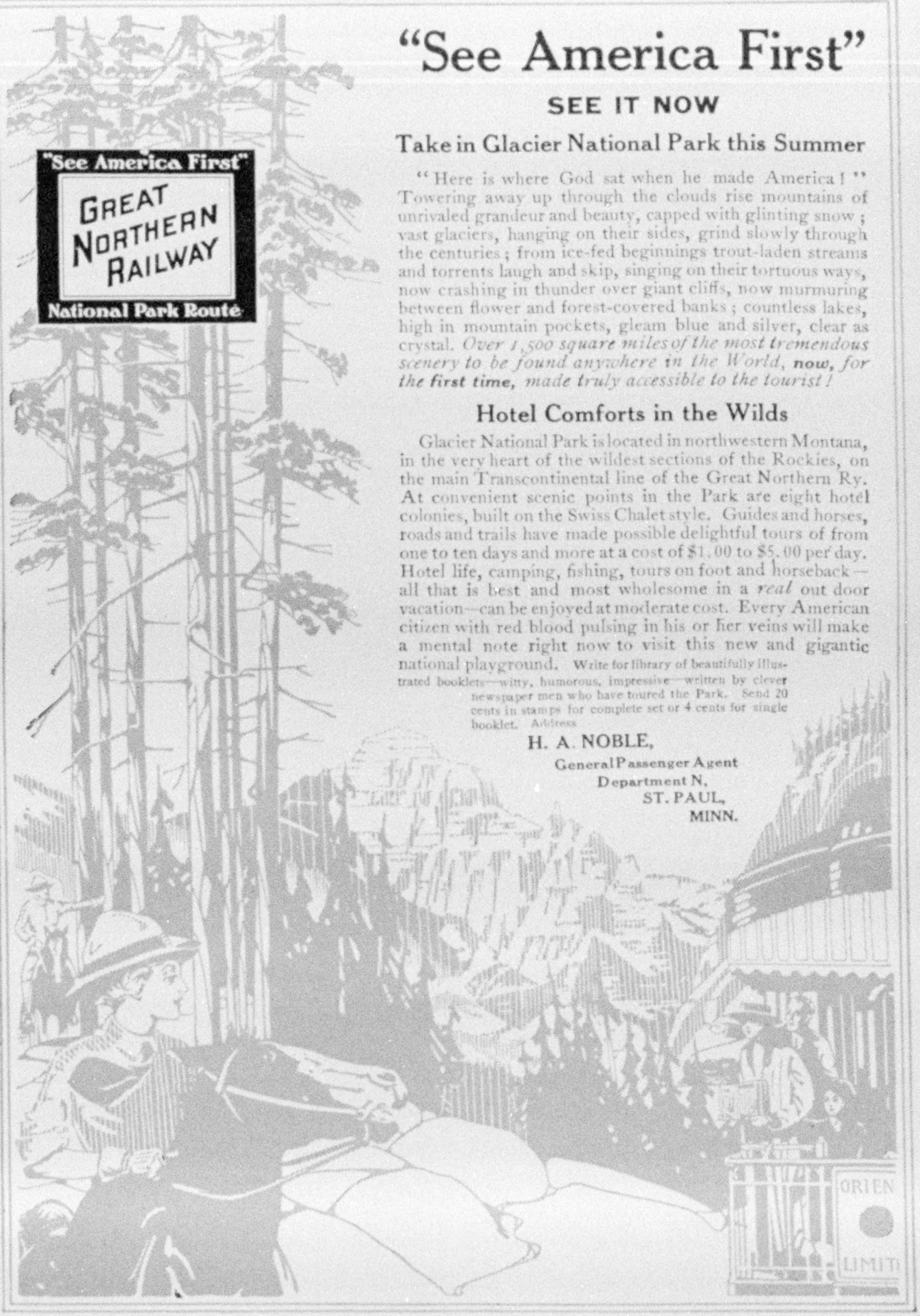

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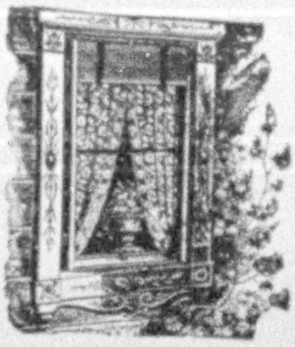
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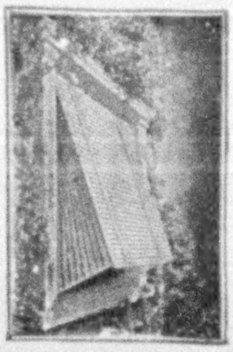
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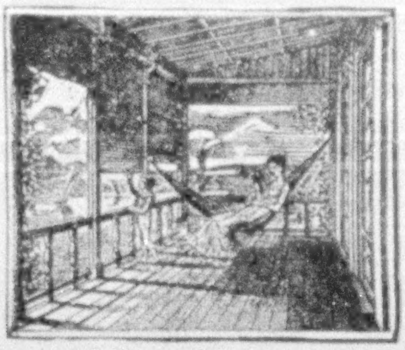
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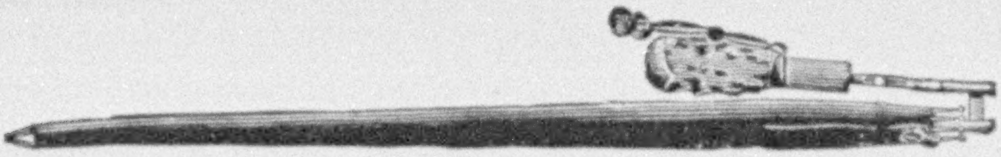

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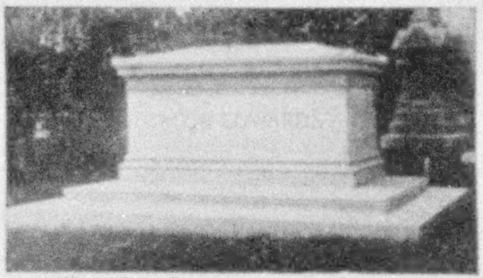
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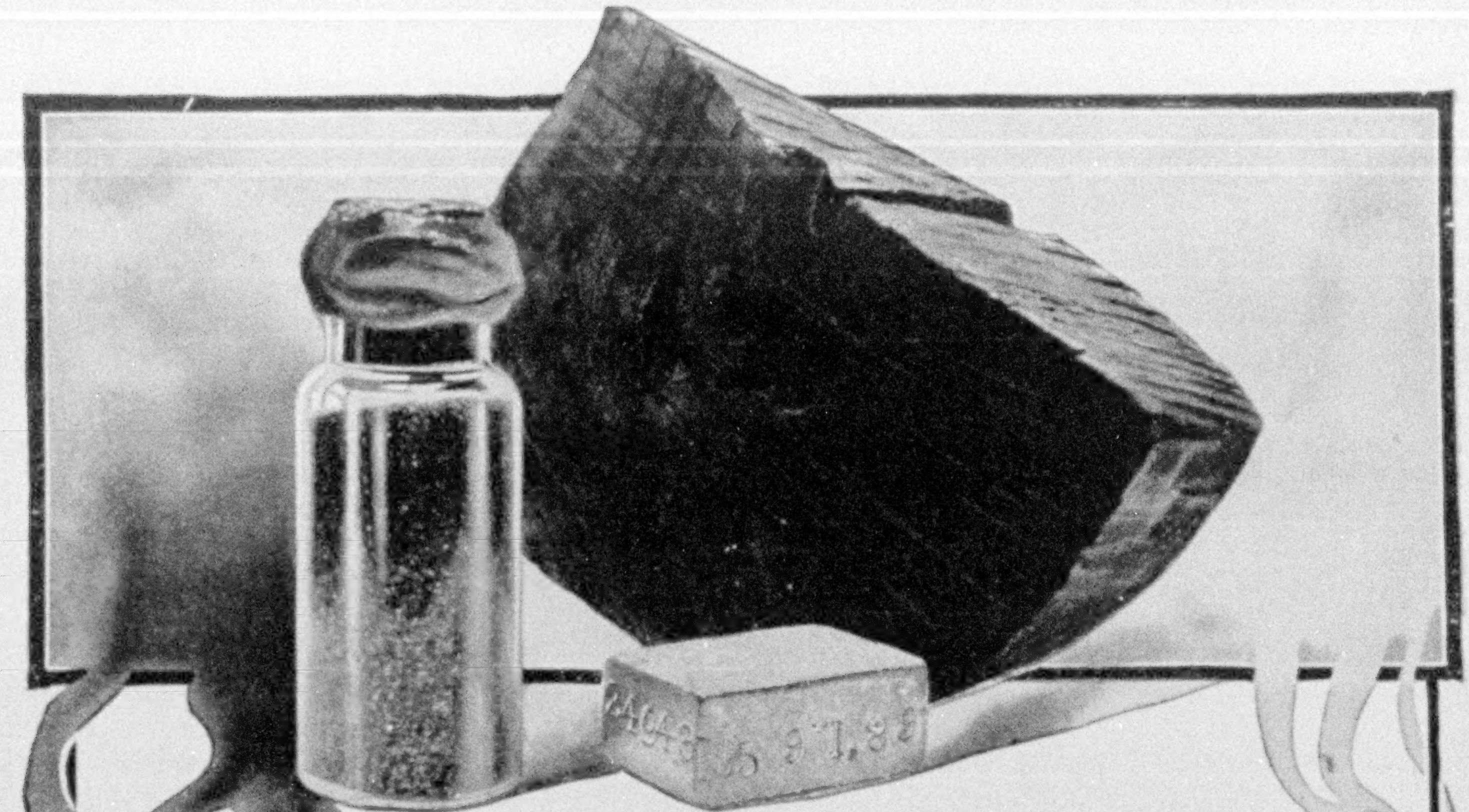

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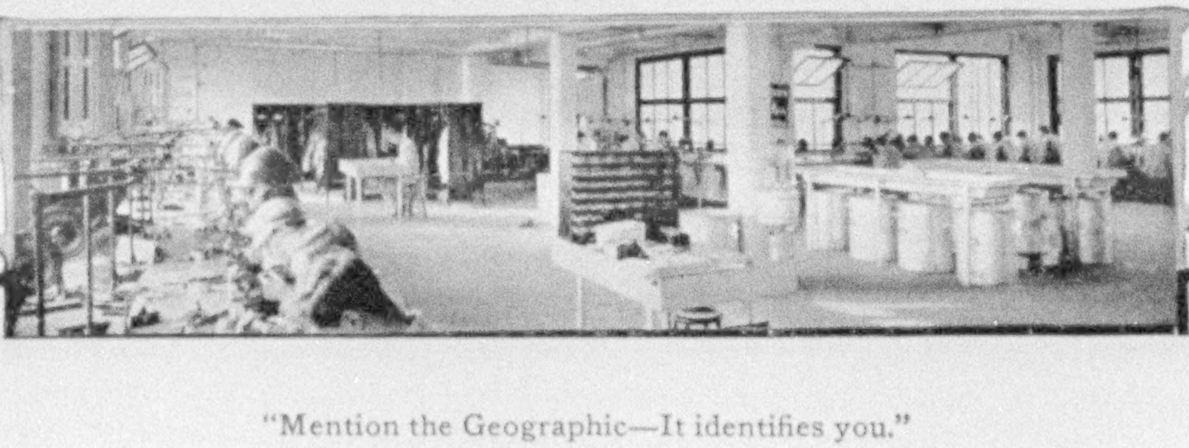

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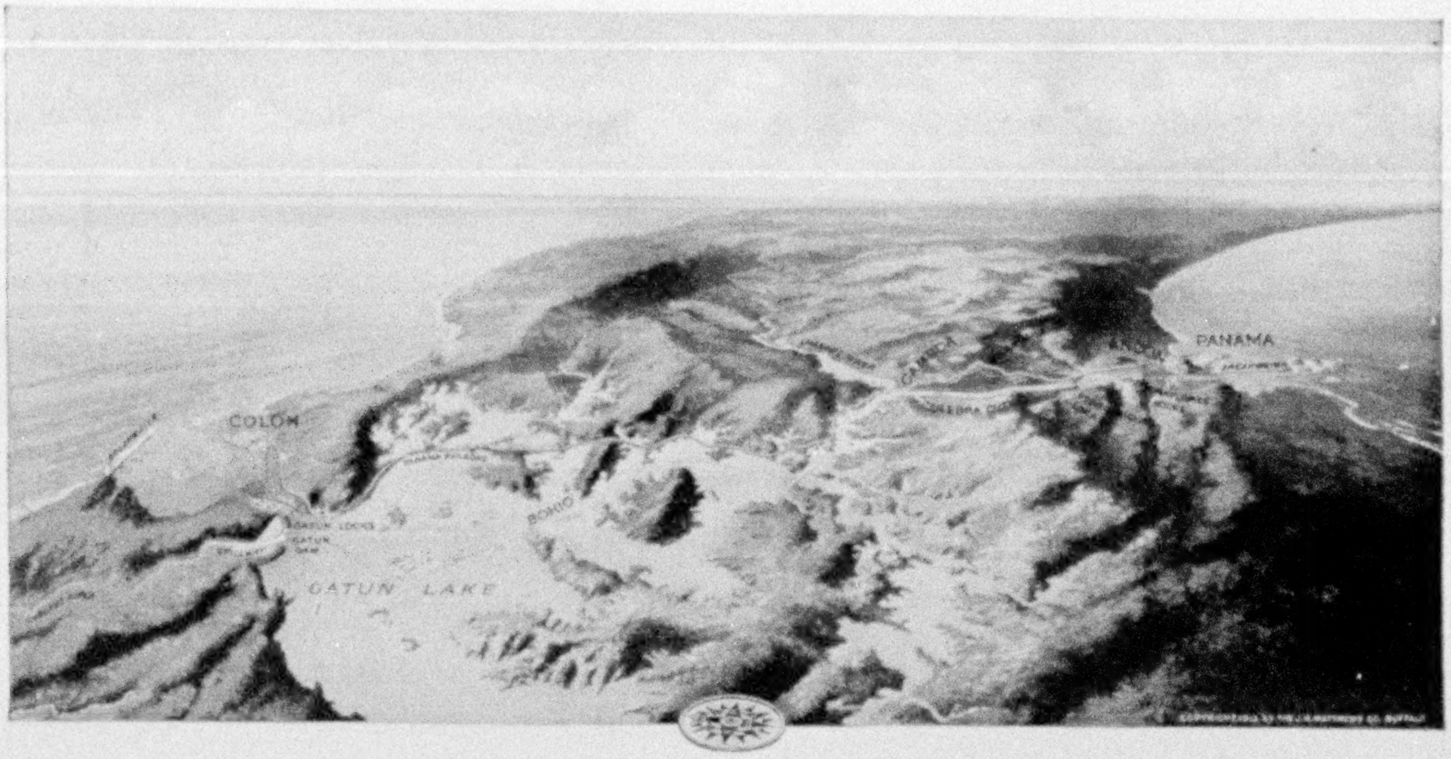

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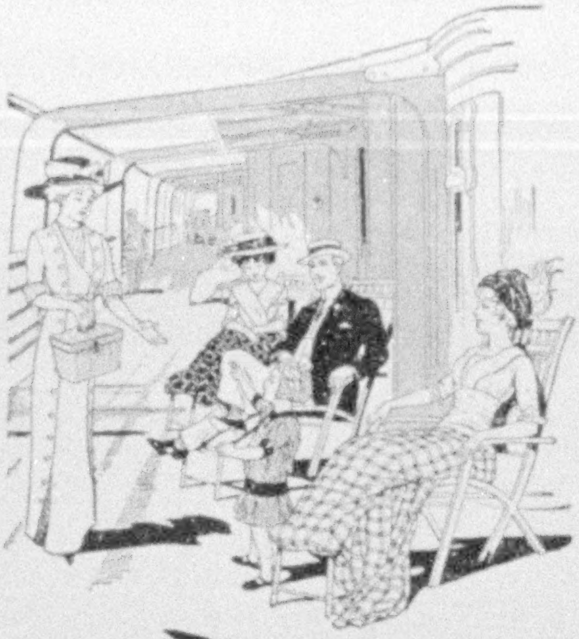

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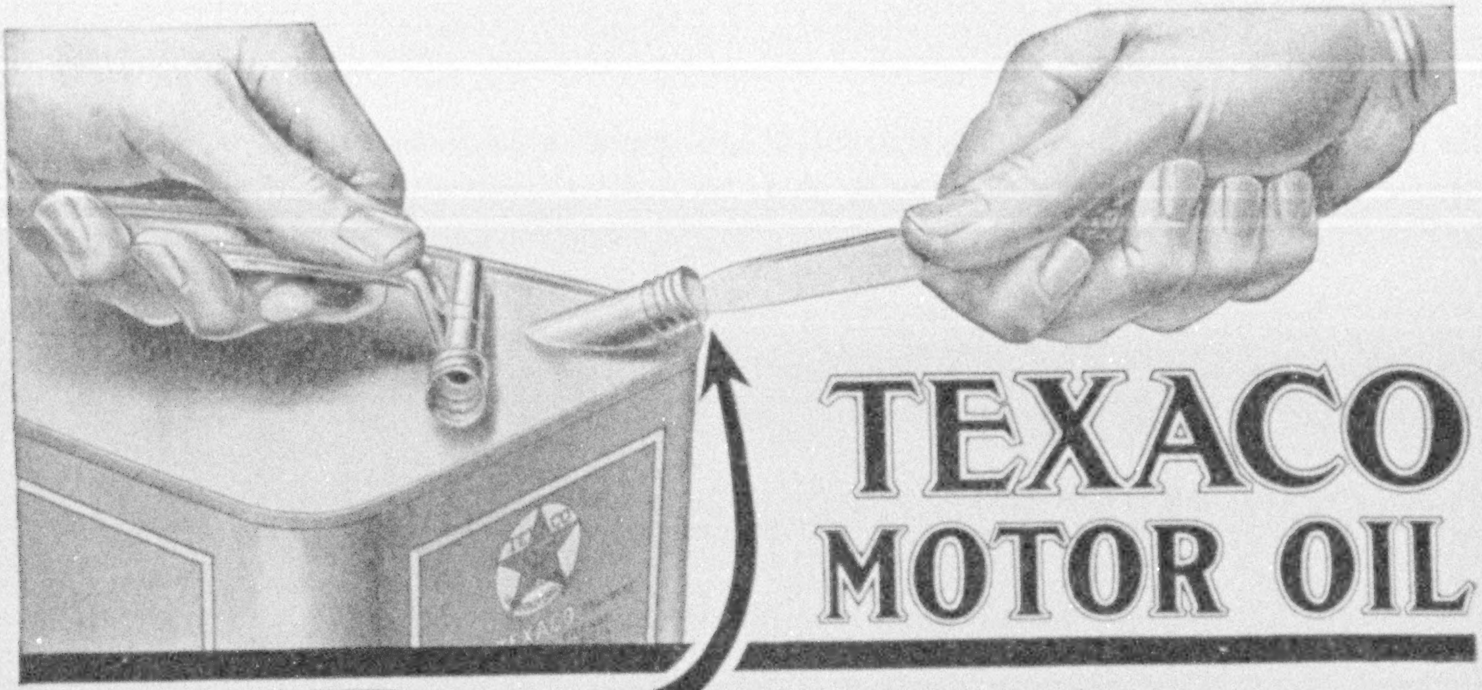

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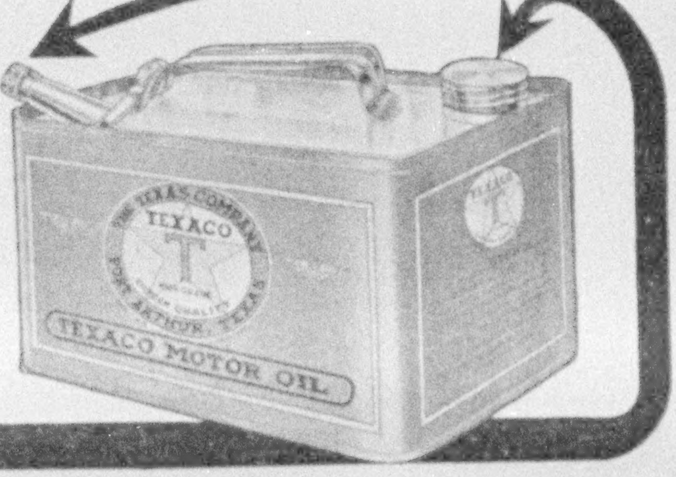

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